

REVISION OF *NEOSARMATIUM* SERÈNE AND SOH (CRUSTACEA: BRACHYURA: SESARMINAE) WITH DESCRIPTIONS OF TWO NEW SPECIES

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*Neosarmatium* Serène & Soh, 1970, is revised and re-diagnosed. Crabs of this genus are primarily characterised by a deeply vaulted, sub-quadrate, carapace, with the anterolateral margins with 0-2 teeth behind the exorbital angles; the upper surface of the palm of the chelipeds is without pectinate crests and usually defined anteriorly by a swollen longitudinal ridge; the outer surface of the palm usually with a median longitudinal row and the dorsal surface of the dactyl often bearing spines or blunt teeth; the legs are of medium length, flattened, and broad. Twelve *Neosarmatium* species are recognised as valid, including two new species: *N. fourmanoiri* Serène, 1973, *N. indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), *N. laeve* (A. Milne Edwards, 1869), *N. malabaricum* (Henderson, 1893), *N. meinerti* (De Man, 1887), *N. punctatum* (A. Milne Edwards, 1873), *N. rotundifrons* (A. Milne Edwards, 1869), *N. smithi* (H. Milne Edwards, 1853), *N. spinicarpus* sp. nov. and *N. trispinosum* sp. nov. Records of *Neosarmatium indicum*, *N. punctatum* and *N. malabaricum* have been confused, and the identities of these species have now been clarified after examination of the type specimens. The identity of *N. laeve* (A. Milne Edwards, 1869) as a senior synonym for *N. aequifrons* (Rathbun, 1914) and *N. ambonensis* Serène & Moosa, 1971, is clarified for the first time. *N. biroi* (Nobili, 1905) is considered a junior synonym of *N. integrum* (A. Milne Edwards, 1873). *Neosarmatium trispinosum* sp. nov. has long been confused with *N. smithi*, from which it can be easily separated by the shape and position of the teeth on the upper margin of the dactyl of the male cheliped. All records of *N. smithi* from the coast of Queensland, including published ecological studies, refer to *N. trispinosum* sp. nov. Lectotypes are designated for *Neosarmatium indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), and *N. punctatum* (A. Milne Edwards, 1873). □ Crustacea, Brachyura, Grapsidae, Sesarminae, *Neosarmatium*, mangroves, Indo-West Pacific, new species.

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Crabs of the genus *Neosarmatium* are among the largest of the intertidal mangrove sesarminae. The species that have so far been studied are primarily herbivorous, and along with other sesarminae, appear to be responsible for consuming a large percentage of the annual leaf fall of mangrove forests (Robertson & Daniel, 1989; Robertson, 1991; Smith et al., 1991).

The present paper is the third (see Davie, 1992, 1993) in a projected series of works intended to revise the genus *Sesarma* s.l. and clarify and correct some of the problems that have arisen from Serène & Soh's somewhat premature 1970 paper diagnosing 10 new genera, and 3 new subgenera.

*Neosarmatium* was diagnosed by Serène & Soh (1970), to include a number of Indo-West Pacific species previously included in *Sesarma* (*Sesarma*) or *Sarmatium* Dana. Davie (1992) has revised *Sarmatium* and clearly defined its generic

limits. Six of the species that were placed in *Sarmatium* by Tesch (1917): *S. integrum* A. Milne Edwards, 1873, *S. inermis* De Man, 1887, *S. indicum* A. Milne Edwards, 1868, *S. punctatum* A. Milne Edwards, 1873, *S. biroi* Nobili, 1905 (= *integrum*) and *S. fryatti* Tesch, 1917 (= *rotundifrons* A. Milne Edwards, 1869) are now all included in *Neosarmatium*.

I have given references to non-taxonomic papers concerning some species. This listing is not meant to be exhaustive. It is primarily provided in an attempt to clarify cases where such authors have wrongly identified their study animals; and secondarily as an introduction to other biological studies.

While I have provided a full new description for most species, in several cases I have provided only a diagnosis because comprehensive and/or recent descriptions are available.

The descriptions for this paper were prepared

using the DELTA computer system for generating taxonomic descriptions (Dallwitz & Paine, 1986). Measurements given in the text are of the carapace breadth (measured at the widest point) followed by length. Leg segments were measured in a straight line to give maximum dorsal length and so are not always the maximum possible length. The exact limits of the width of the posterior margin of the carapace are also sometimes difficult to determine and in this work they were defined by the point at which the lateral carapace suture meets the posterior margin. Gonopod terminology follows that of Sakai & Yatsuzuka (1979).

ABBREVIATIONS USED: c.b., carapace breadth; Ck, Creek; BMNH, British Museum (Natural History); MNHN, Muséum national d'Histoire naturelle, Paris; ZRC, Zoological Reference Collection, Department of Zoology, National University of Singapore; NNM, National Natural History Museum, Leiden; NT, Northern Territory, Australia; ppt, parts per thousand; QLD, Queensland, Australia (ME.QLD = mid-eastern Queensland; NE.QLD = north-eastern Queensland etc.); QMW, Queensland Museum, Brisbane; SMF, Senckenberg Museum, Frankfurt; USNM, National Museum of Natural History, Washington; Z.D.U.Q., Zoology Department University of Queensland; ZMG, Zoological Museum of Goettingen (collection now housed at SMF); ZMH, Zoologisches Institut und Zoologisches Museum, Universität Hamburg; ZMK, Zoological Museum, University of Copenhagen.

## SYSTEMATICS

### *Neosarmatium* Serène & Soh, 1970

*Metagrapsus*: A. Milne Edwards, 1873: 308; De Man, 1880: 31; Kingsley, 1880: 212 [not *Metagrapsus* H. Milne Edwards, 1853: 188].

*Neosarmatium* Serène & Soh, 1970: 397, 405; Sakai, 1976: 665.

#### TYPE SPECIES

*Sesarma smithi* H. Milne Edwards, 1853, by original designation; gender is neuter.

#### DIAGNOSIS

Carapace sub-quadrate; greatest width behind exorbital angles; breadth greater than length. Carapace deeply vaulted; slightly convex laterally. Regions moderately well defined. Anterolateral margins with 0-2 teeth behind ex-

orbital angle. Front moderately to strongly deflexed; with broad median concavity. Post-frontal lobes distinct. Orbital hiatus open. Basal segment of antennal peduncle with well developed outer tongue-like lobe. Inter-antennular septum relatively narrow. Pterygostomial region with well developed reticulation of inter-crossing lines of setae. Third maxilliped merus and ischium subequal; merus longer than wide, outer margin convex; ischium sub-triangular; palp articulating near outer distal margin of merus; exopod narrow, reaching about half length of merus. Chelipeds subequal, large and robust; merus usually with distinct subdistal spine on posterior border; carpus with inner angle slightly produced; upper surface of palm usually, but not always, defined anteriorly by swollen longitudinal ridge; without pectinate crests; outer surface of palm punctate, naked, usually with median longitudinal row, without ventral ridge. Dorsal surface of dactyl usually bearing spines. Fingers pointed; curved slightly inwards; wide gape between cutting margins in adult males. Legs medium length, flattened, broad. Dactyli stout and slightly recurved; terminating in acute chitinous tip. Merus anterior margin with acute sub-distal spine; unarmed terminally. Carpus with accessory carinae on upper surface. Propodus with an accessory carina on inferior proximal portion of upper surface. Merus of last leg smooth, meri of other legs with scattering of small distally directed prickles. Male abdomen often remarkably elongate; relatively narrow; third segment widest; first segment broad, covering entire width of sternum between 4th pereopods. G1 long, reaching just past suture between sternites 3 and 4; moderately stout to slender, curved; apical process present, corneous, strongly produced, straight; gonopore terminal; seta short, simple, lying around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

*Neosarmatium* species recognised as valid in this paper: *N. fourmanoïri* Serène, 1973, *N. indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), *N. laeve* (A. Milne Edwards, 1869), *N. malabaricum* (Henderson, 1893), *N. meinerti* (De Man, 1887), *N. punctatum* (A. Milne Edwards, 1873), *N. rotundifrons* (A. Milne Edwards, 1869), *N. smithi* (H. Milne Edwards, 1853), *N. spinicarpus* sp. nov. and *N. trispinosum* sp. nov.

KEY TO THE SPECIES OF *NEOSARMATIUM*

(Although the key relies heavily on male claw characters, the female chelae usually show the same features, albeit much less obviously, and can therefore usually also be identified. Features enclosed in '[ ]' are included as extra, specific diagnostic characters).

1. Side of carapace without anterolateral teeth separated by a deep notch from the rest of the margin, a single anterolateral tooth may be present as an angular projection [Exorbital breadth sub-equal to length of carapace. Outer surface of palm of cheliped punctate; inner surface with a low granular crest. Colour: purple, chelipeds, pereopods and edges of carapace reddish. Male unknown.] . . . . . *integrum* (A. Milne Edwards, 1873)  
Side of carapace with one or two anterolateral teeth (second usually reduced to an angular projection) . . . . . 2
2. Dactyl of male cheliped with strong chitinous teeth on dorsal margin . . . . . 3  
Dactyl of male cheliped either without strong chitinous teeth on dorsal margin, or bearing small, sharp, chitinous spinules only . . . . . 9
3. Dactyl of male cheliped with 2 teeth on dorsal margin . . . . . 4  
Dactyl of male cheliped with 3-5 teeth on dorsal margin . . . . . 6
4. Inner surface of palm without a strongly raised, granular, vertical crest (4-5 granules may be prominent on large males but are not raised onto a crest); outer surface of male chela with a protruding basal shelf on fixed finger below gape . . . . . *N. indicum* (A. Milne Edwards, 1868)  
Inner surface of palm with a strongly raised, granular, vertical crest; male chela normal in form, not having a protruding basal shelf on fixed finger below gape . . . . . 5
5. Distal tooth on upper surface of dactyl placed close to middle; upper surface of palm of cheliped with a strong longitudinal rim marking its outer edge; carapace 1.15-1.25 times longer than wide . . . . . *N. malabaricum* (Henderson, 1893)  
Distal tooth on upper surface of dactyl placed clearly less than half-way to the tip; longitudinal rim present on upper surface of

- palm of cheliped but not strongly differentiated; carapace 1.25-1.35 times longer than wide . . . . . *N. punctatum* (A. Milne Edwards, 1873)
6. Dactyl of male cheliped with 3 teeth on dorsal margin [carapace length c. 1.1 times breadth; strong vertical crest on inside of chela; sixth segment of male abdomen strongly elongated] . . . . . 7  
Dactyl of male cheliped with 4-5 teeth on dorsal margin . . . . . 8
  7. Dactylar teeth truncate, spaced evenly over proximal half . . . . . *smithi* (H. Milne Edwards, 1853)  
Dactylar teeth acute, set close together over proximal two-fifths . . . . . *trispinosum* sp. nov.
  8. Carapace sub-quadrate, maximum carapace width between tips of first anterolateral teeth; 4 evenly spaced, dactylar tubercles; frontal margin without strong median concavity; median and lateral postfrontal lobes of similar width, and not swollen; small species . . . . . *laeve* (A. Milne Edwards, 1869)  
Carapace with lateral margins markedly convex anterolaterally, maximum carapace width behind tips of first anterolateral teeth; 4 dactylar tubercles; frontal margin with a strong median concavity; median postfrontal lobes wider than laterals, and strongly swollen; large species . . . . . *rotundifrons* (A. Milne Edwards, 1869)
  9. Dactyl of cheliped smooth, unarmed [walking legs relatively slender, length of merus of third walking leg 2.6-2.7 times width; male first pleopod short, with distal portion not strongly narrowing, and not much twisted] . . . . . 10  
Dactyl of cheliped armed with small, sharp, chitinous spinules . . . . . 11
  10. Inner angle of carpus of cheliped unarmed; inner face of palm with vertical row of granules behind gape . . . . . *inermis* (De Man, 1887)  
Inner angle of carpus of cheliped armed with acute granular projection; inner face of palm with a patch of granules ventrally but not extending as a vertical row behind gape . . . . . *spinicarpus* sp. nov.
  11. Male chela c. 1.7 times longer than high;

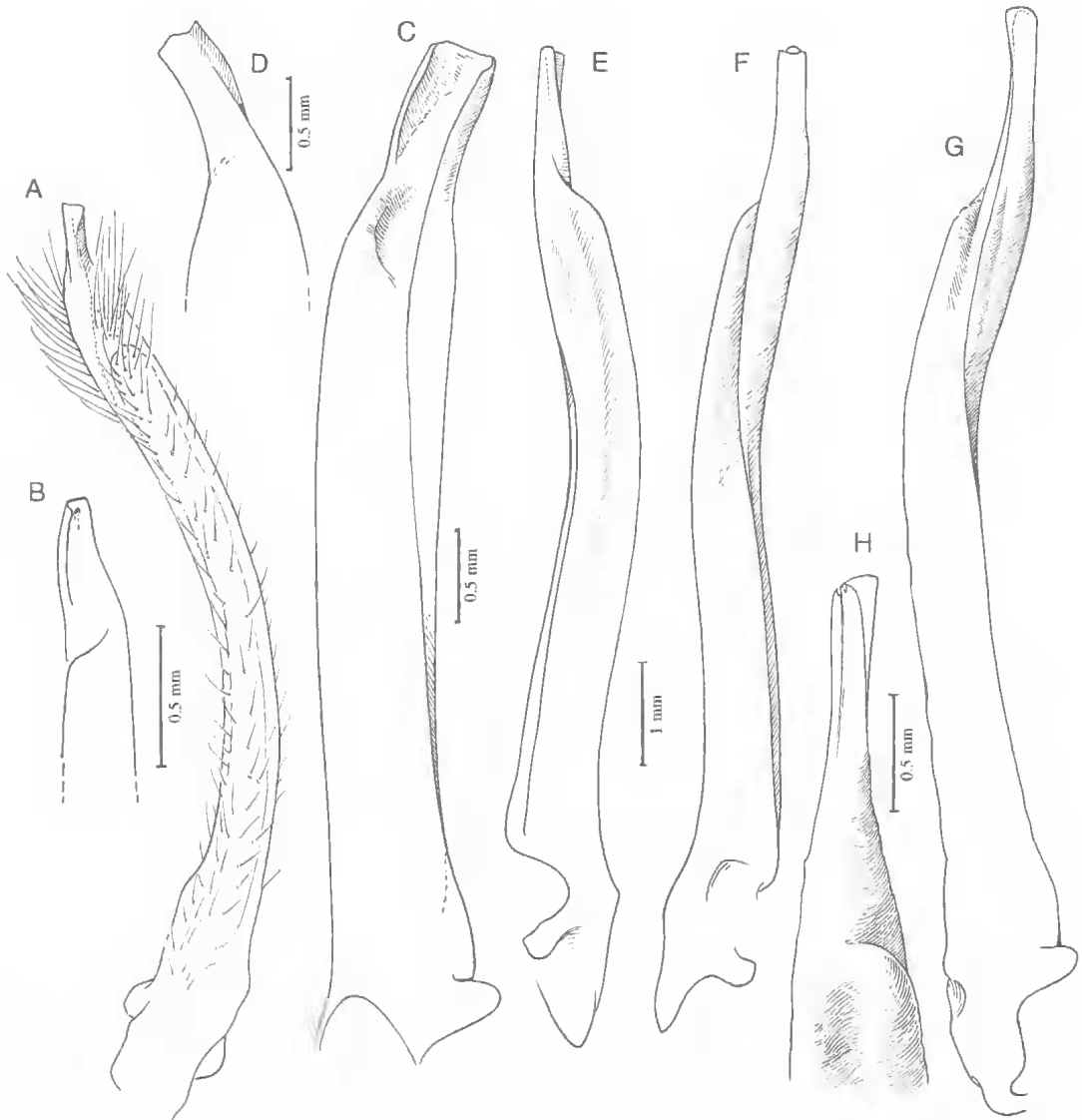


FIG. 1. Male first gonopods (setae removed except for A). A, B, *Neosarmatium laeve* (A. Milne Edwards) [specimen figured is the holotype of *N. aequifrons* (Rathbun)]; C, D, *N. inerme* (De Man), ZMH4080; E, F, *N. indicum* (A. Milne Edwards), ZRC1989.3670; G, H, *N. malabaricum* (Henderson), MNHN-B10461.

lower margin evenly convex; dactylar spinules evenly spaced in a single row, and extending only to about half length of dactyl; vertical granular row on inside of chela strongly developed .....  
 ..... *meinerti* (De Man, 1887)

Male chela c.1.8 times longer than high; lower margin straight behind fixed finger; dactylar spinules more numerous, not confined to a single row, and extending almost to tip of dactyl; vertical granular row on inside of chela lower than in *N. meinerti* .....  
 ..... *fourmanoiri* Serène, 1973

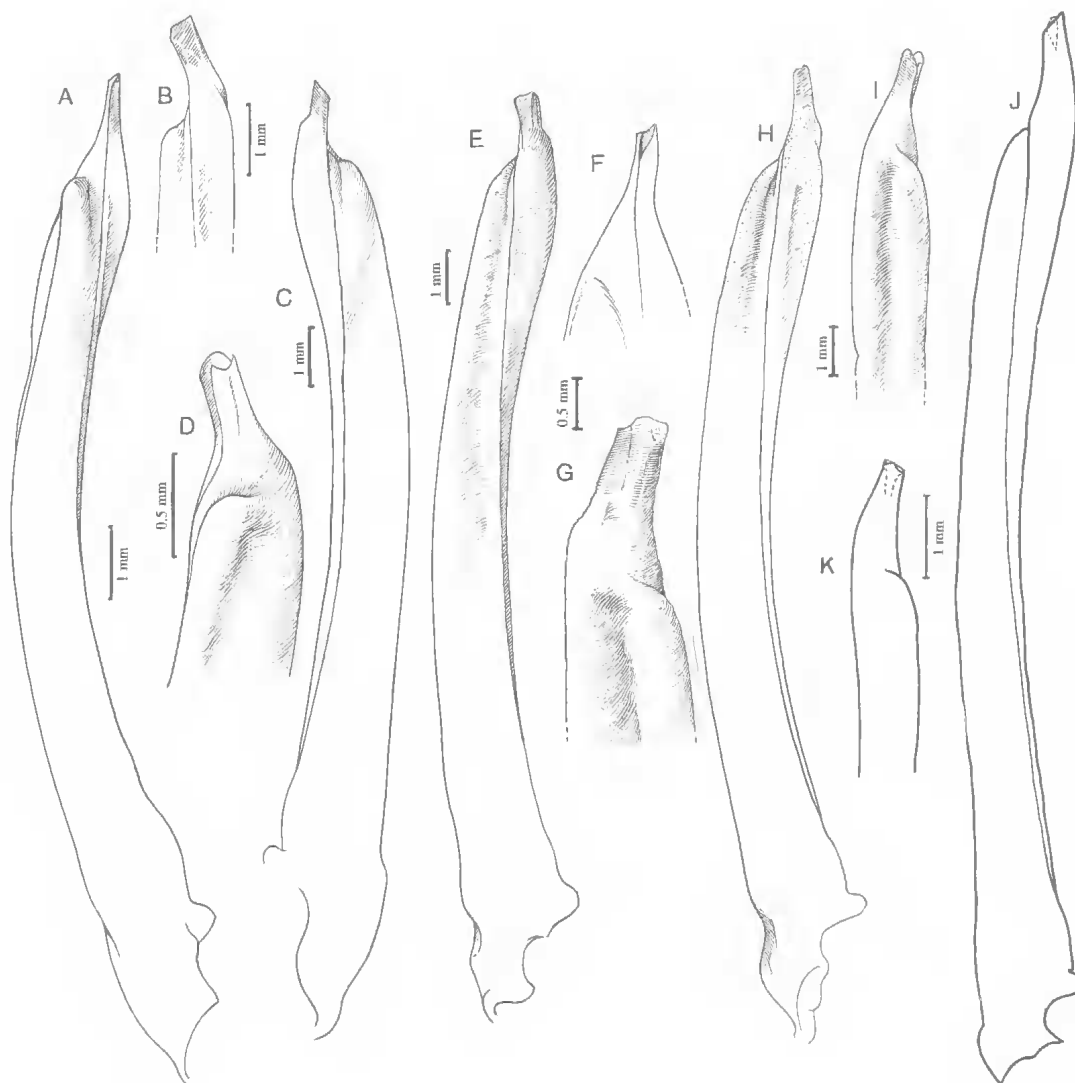


FIG. 2. Male first gonopods (setae removed). A, B, *N. rotundifrons* (A. Milne Edwards) [specimen figured is the holotype of *N. fryatti* (Tesch)]; C, D, *N. fourmanoiri* Serène, holotype, MNHN-B10459; E, F, G, *N. meinerti* (De Man), MNHN-B16735; H, I, *N. trispinosum* sp. nov., MNHN unreg., New Caledonia (41.2 x 36.4 mm); J, K, *N. smithi* (H. Milne Edwards), QMW8861.

***Neosarmatium fourmanoiri*** Serène, 1973  
(Figs 2C, D; 3; 16)

*Sesarma tetragona*: A. Milne Edwards, 1873: 304, pl. 16, fig. 4 [not *Cancer tetragona* Fabricius, 1798: 341].

? *Sesarma Meinerti*: Nobili, 1907: 405 [not *Sesarma meinerti* De Man, 1887].

*Sesarma meinerti*: McCulloch, 1913: 322-23.

*Neosarmatium fourmanoiri* Serène, 1973: 126-129, pl.3 A-C.

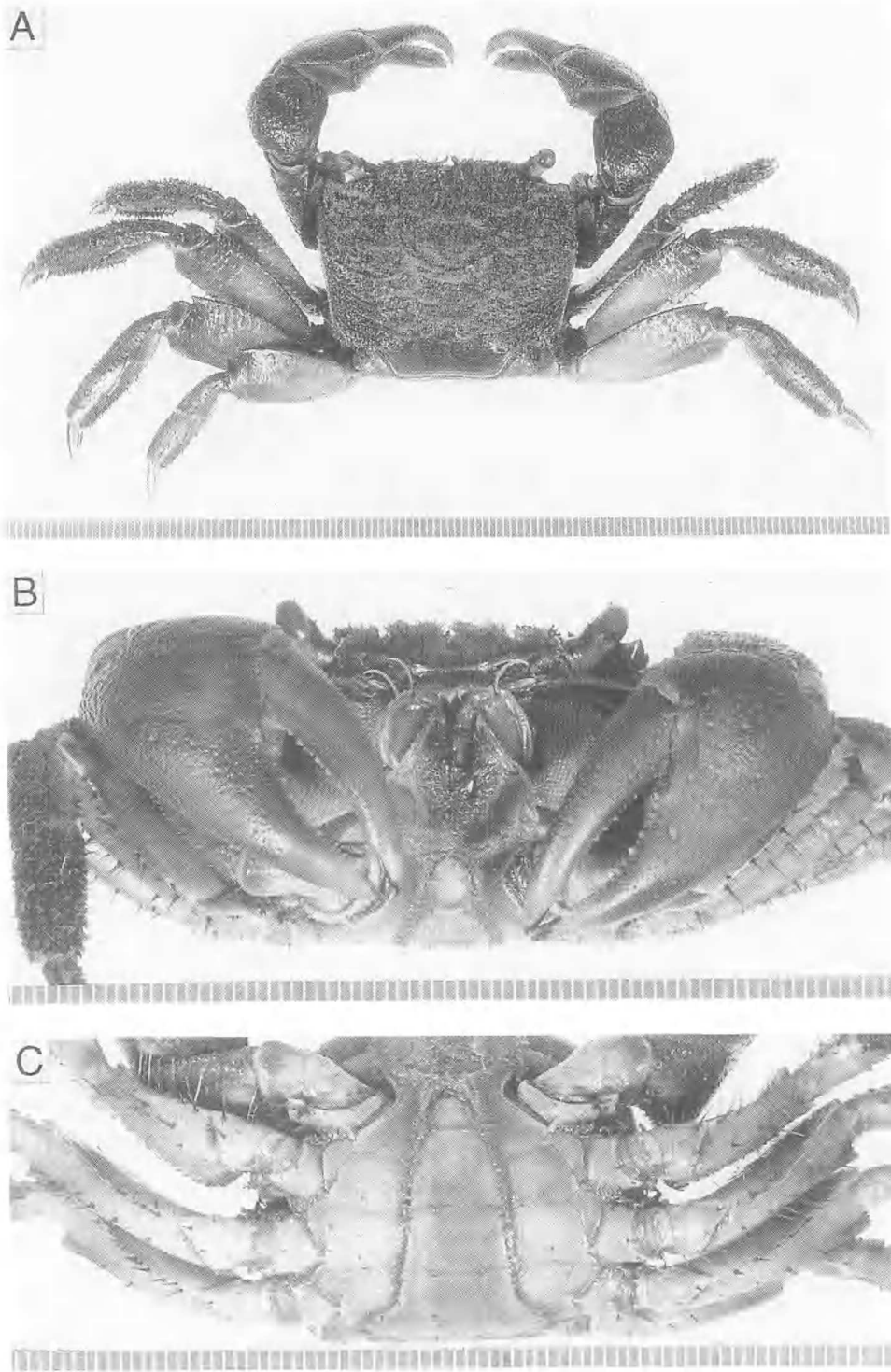


FIG. 3. *Neosarmatium fourmanoiri* Serène, 1973, ♂, QMW4598. A, dorsal view; B, frontal view; C, ventral view. Scale line in mm.

## TYPE INFORMATION

Holotype, MNHN-B10459. Type locality: New Caledonia.

## MATERIAL EXAMINED

HOLOTYPE: MNHN-B10459, ♂ (38.3 x 31.7mm), New Caledonia, R. Serène, 4.9.1971.

OTHER MATERIAL: NEW CALEDONIA: QMW-19558, ♂ (44.1 x 36.6mm), Pam, north New Caledonia, mangroves, 27.2.1992, J. Menou. VANUATU: MNHN unreg., ♂ (38.9 x 31.6mm), *Rhizophora/Xylocarpus* mangroves, in lagoon by Banana Plantation, R. Serène, 10.10.1971; MNHN unreg. (Serène coll.), ♀ (36.0 x 28.0mm), Port Stanley, tidal edge at high water, *Rhizophora/Cerriops* interface, A.G. Marshall, 2.10.1971. INDONESIA: NNMD170, ♂ (35.0 x 29.2mm), Sula Senana, E. of Sulawesi; NNMD169, ♀ (26.2 x 21.2mm), Sulawesi; NNMD1539, ♂ (41.4 x 35.4mm), ♀ (38.1 x 32.0mm), Pacific Ocean [Museum Godeffroy 1887]; NNMD40838, 4♀ (30.9 x 24.6; 30.4 x 29.0; 34.9 x 28.0; 35.5 x 28.3mm), from burrows among trees just behind beach, Holtekang, southern part of Humboldt Bay, near Buaja River, northeastern coast of Irian Jaya, New Guinea, L.B. Holthuis, 12.11.1954. AUSTRALIA: QMW8843, 2♂ (33.1 x 26.5; 30.4 x 24.7mm), Port Stewart, NE.QLD, 14°04'S, 143°41'E, B. Campbell, night collected; SMF unreg., ♀ (29.0 x 22.5mm), ♂ (37.9 x 29.4mm), upper edge of bank under stones and logs, Smith Creek, Cairns, NE.QLD, M. Türkay, 5.6.1980; QMW8841, ♂ (38.5 x 31.0mm), ♀ (30.0 x 23.4mm), Cairns side of Yorkey's Knob, NE.QLD, 5 ppt, 16°49'S, 145°43'E, 14.1.1965, B. Campbell; QMW8844, ♂ (36.8 x 29.5mm), Barron River, NE.QLD, 16°52'S, 145°42'E, Z.D.U.Q.; QMW8840, 4♂ (27.7 x 21.4 - 35.4 x 29.0mm), 5♀ (27.1 x 21.5 - 29.8 x 23.3mm), Airport Swamp, Cairns, NE.QLD, 16°53'S, 145°45'E, Z.D.U.Q.; QMW1123, (dried varnished spec.), Barron Beach, via Cairns, NE.QLD, 16°55'S, 145°46'E; QMW8842, ♂ (33.9 x 26.5mm), Trinity Inlet, Cairns, NE.QLD, 16°58'S, 145°47'E, 5.12.1975, Australian Littoral Society; QMW4598, ♂ (34.7 x 29.3mm), nth end of Admiralty Is., Trinity Inlet, Cairns, NE.QLD, 16°58'S, 145°47.0'E, Jan. 1975, M. Graham, found in entrance to burrows in Blady Grass on the edge of a terrestrial ridge amongst the open (4-5m) *Xylocarpus*, *Cerriops*, *Lumnitzera racemosa* and *L. littorea* mangroves; QMW8879, ♀ (31.1 x 23.7mm), Road to Lucinda, near Ingam, NE.QLD, 18°32'S, 146°2'E; QMW8845, ♂ (43.5 x 34.5mm), Townsville, NE.QLD, 19°16'S, 146°49'E, Z.D.U.Q.; QMW12901, 1♂, mangroves behind Gap Beach, Lindeman Is., ME.QLD, 20°27'S, 149°02'E, 25.3.1987, P.Davie, J.Short; QMW12902, 2♂, mangroves behind Gap Beach, Lindeman Is.,

ME.QLD, 20°27'S, 149°02'E, 27.3.1987, P.Davie, J.Short.

## DESCRIPTION

*Carapace*. c.1.2 times broader than long. Fronto-orbital width c.1.1 times carapace length. Depth c.0.7 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; slightly convex, or straight. Anterolateral margins with a single epibranchial tooth. Exorbital angle triangular and sharp. Anterolateral tooth triangular and sharp; similar in size to exorbital angle. Front c.0.55 times carapace width; c.0.6 times fronto-orbital width; pre-orbital concavity present; lateral margins parallel and convex. Post-frontal lobes with clumps of stout setae meeting over frontal furrow, and each with fringe of prominent dark setae. Short ridge medially on first epibranchial tooth. Branchial ridges prominent; first follows from typical position of second epibranchial tooth, relatively long; second arising just short of lateral margin; other ridges also arise near lateral margin; last ridge long, curved over base of last leg. Posterior margin c.0.4 times carapace width. Carapace surface smooth, shining, punctate; wrinkled posteriorly. Soft setae arranged sparsely on branchial lines and in short rows over entire surface; longest and most conspicuous over anterior half, almost lost on intestinal region. Upper orbital border smooth, slightly oblique; moderately convex mesially; inner angle rounded. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.3 times width of front.

*Third maxilliped*. Suture between merus and ischium obliquely sloping inward. Ischium inner margin smooth. Exopod narrow, barely visible in frontal view; c.0.5 times width of ischium.

*Chelipeds*. Merus with posterior border bearing minute granular striations; without distinct subdistal spine; lower border granulate; anterior border tuberculate, tubercles larger in proximal half; carpus with inner angle not produced; inner margin granular, rectangular facet more-or-less defined by two granular ridges; males (but not females) lacking brush of stiff setae on ventro-proximal end of this facet characteristic of other species; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm not defined anteriorly by a longitudinal ridge. Outer surface of palm naked, microscopically granular, punctate, without median longitudinal row. Inner surface of palm minutely granular; with a low vertical band of

small granules. Immobile finger rounded on outer surface; moderately long; length cutting edge c.0.46 times length propodus. Ventral border of chela straight, or slightly convex. Dorsal surface of dactyl minutely granular. Fingers with tips, corneous, toothed, intermeshing; curved inwards; a moderate gape between cutting margins.

*Walking legs.* Second pair the longest, c.1.7 times maximum carapace width. Merus of third leg c.2.3 times as long as wide. Carpus c.2.3 times as long as wide. Propodus c.2.1 times as long as wide. Dactyli about equal to length of propodi. Meri of legs 1-3 with scattering of small distally directed prickles, arranged on transverse crests in upper part. Meri generally without setae except for some longer bristles ventrally; carpi and propodi bear a thick fur of soft setae on anterior and posterior margins, most extensive on the first two pairs where the setae also cover most of the ventral face of these segments, but reduced to a sparse, narrow, vestige on last pair; setae continue onto dactyli in narrow rows.

*Male abdomen.* Segment 1 narrow, c.0.9 times width segment 3. Width segment 3 c.4.2 times length. Segment 6 elongated; 1.1 times wider than long. Telson much shorter than segment 6; slightly shorter or subequal to segment 5; c.1.3 times longer than wide; evenly rounded.

*Gonopods.* G1 inner-dorsal margin straight and distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of the stem broad. Apical process present, corneous, moderately produced, straight. Gonopore terminal. Setae long and displaced around apex, obscuring structural detail. G2 short, straight, narrow, evenly tapering, slightly twisted.

#### COLOUR

The carapace and walking legs are a dark violet brown, nearly black. The chelipeds are a uniform bright dark red or (rarely) dark purplish.

#### REMARKS

*Neosarmatium fourmanoiri* bears a very close resemblance to *N. meinerti*. The main differences are:

1. The chelae of *N. fourmanoiri* are proportionately not as high, the mean length to height ratio being 1.81 compared to 1.70 in *N. meinerti* although there is some overlap between individual specimens; 2. The gape between the fingers of adult male *N. fourmanoiri* is compara-

tively much less than in *N. meinerti*; 3. The vertical crest on the inside of the palm of *N. meinerti* has a single even row of comparatively much larger tubercles; 4. The chitinous tubercles on the superior margin of the finger in *N. fourmanoiri* are fine, and form a broad band which extends almost to the tip. In *N. meinerti* they are coarser, uniform in size, evenly spaced in a single row, and only extend over the proximal half; 5. On the male chelae of *N. fourmanoiri* the outer edge of the articulation joint with the dactyl is oblique, and continues onto the cutting margin in a long smooth shallow continuous arc; in *N. meinerti* the edge of the joint is much more vertical and meets the fixed finger in a more angular fashion; 6. On the male chelae of *N. fourmanoiri* the lower border of the palm is more-or-less straight behind the fixed finger, whereas in *N. meinerti* it is evenly convex; 7. The carpus of the male cheliped of *N. fourmanoiri* lacks a brush of stiff setae below the inner proximal end of the rectangular facet; 8. The hirsute areas of the carapace are relatively denser in *N. fourmanoiri* than in *N. meinerti*; 9. Live colouration is different (see Descriptions).

The abdominal segments and the first male pleopod show no appreciable differences.

Female specimens of both species are difficult to distinguish. The most useful characters seem to be the development of the granular row on the inside of the palm of the chela (stronger in *N. meinerti*) and the dactylar tubercles which are more numerous on *N. fourmanoiri* and continue most of the way to the tip, whereas on *N. meinerti* they finish about half way down.

#### HABITAT

From estuaries or mangrove swamps in large burrows (about 5cm diameter). Occurs in a variety of micro-habitats and mangrove forest types - among *Sesuvium* near H.W.S.; in open, well above H.W.S.; in entrance to burrows in Blady Grass on the edge of a terrestrial ridge amongst open (4-5m) *Xylocarpus*, *Ceriops*, *Lumnitzera racemosa* and *L. littorea* mangroves; in wet *Rhizophora* zone mangroves behind sandy beach; tidal edge at high water, *Rhizophora/Ceriops* interface; upper edge of bank under stones and logs. The burrows extend through firm mud or even hard earth for about 1m to the water table. Recorded salinities cover a wide range from <1 ppt L.W.N. (21 ppt in stagnant pools) at Ross Ck., to >33 ppt in a ditch beside the road to Lucinda.



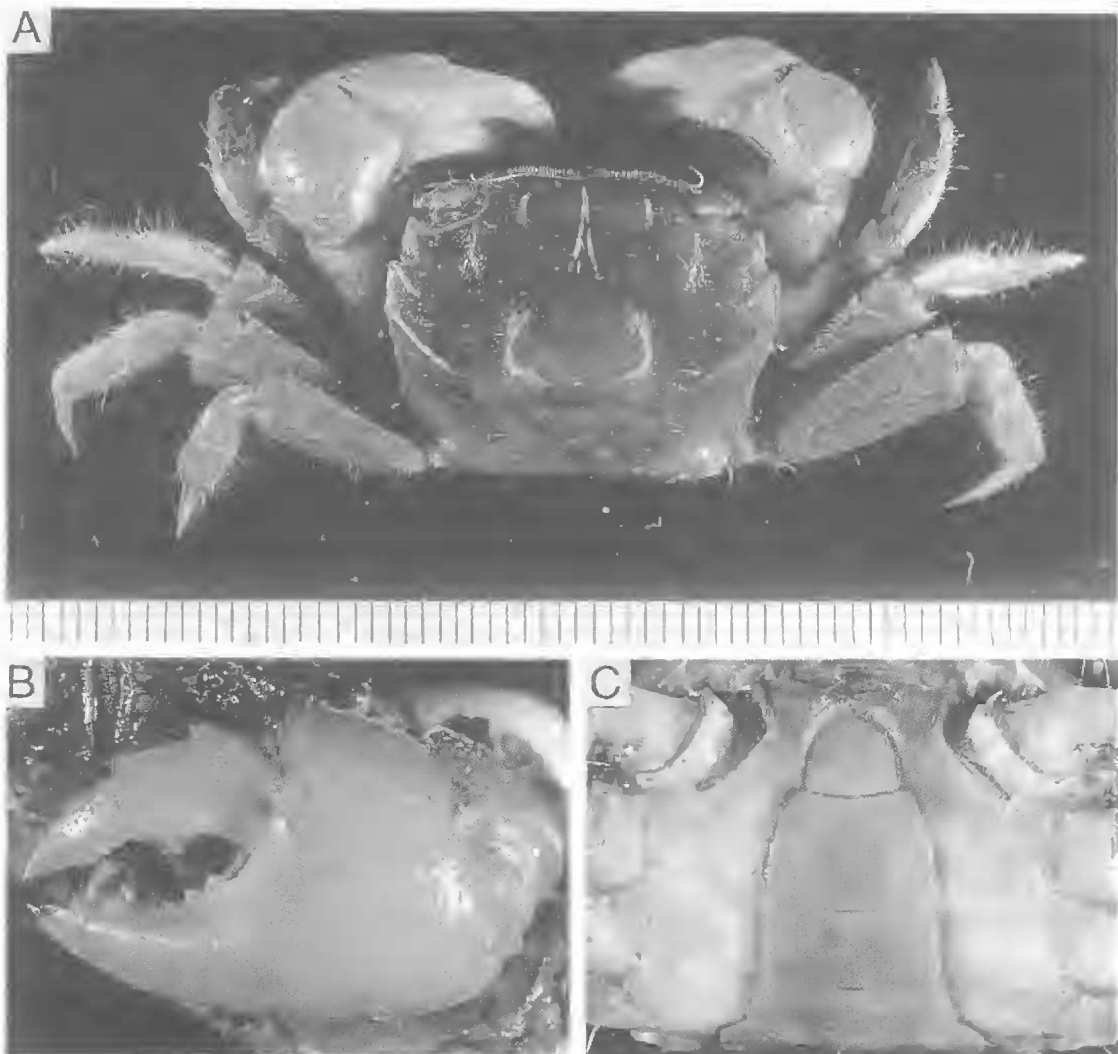


FIG. 4. *Neosarmatium indicum* (A. Milne Edwards, 1868), ♂, ZRC1975, 6.30.15. A, dorsal view; B, chela; C, sternum and male abdomen. Scale line in mm.

#### DISTRIBUTION

New Caledonia (Serène, 1973); from Lindeman Is., ME.QLD, to Port Stewart, Princess Charlotte Bay, NE.QLD; Vanuatu; northeastern coast of Irian Jaya, New Guinea, to Sulawesi, Indonesia (present records). Nobili's (1907) record of *N. meinerti* (no discussion or figure provided) from Apia, Samoa is probably also *N. fourmanoiri*.

#### *Neosarmatium indicum* (A. Milne Edwards, 1868) (Figs 1E, F; 4; 17)

*Metagrapsus indicus* A. Milne Edwards, 1868b: 174, pl. 26, figs 1-5.

? *Sesarma indica*: Heller, 1865: 64 (in part, probably the specimens from the Nicobars refer to valid *N. indicum*) [not *Sesarma indica* H. Milne Edwards, 1837 (= *Tiomanium indicum*)].

*Metagrapsus punctatus*: De Man, 1880: 31.

*Sarmatium indicum*: Kingsley, 1880: 350 (no new specimen); De Man, 1887: 660 (no new specimen); 1892: 350; Tesch, 1917: 220.

*Sarmatium punctatum*: Tesch, 1917: 221; 1918: 115.  
 ? *Sarmatium punctatum*: Urita, 1926: 20; Sakai, 1934: 325.  
*Sesarma (Sarmatium) punctata*: Tweedie, 1940: 109; 1950b: 353.  
*Sesarma punctata*: Tweedie, 1950a: 94.  
*Neosarmatium punctatum*: Soh, 1978: 10, pl. 3b.

#### TYPE INFORMATION

Lectotype, here designated, MNHN-B10927.  
 Type locality: Celebes (= Sulawesi), Indonesia.

#### MATERIAL EXAMINED

LECTOTYPE: MNHN-B10927, ♂ (25.9 x 20.9 mm), Celebes, Indonesia, M. Riedel.  
 OTHER MATERIAL: INDONESIA: NNMD187, ♂ (26.6 x 20.9 mm), Padang, W. Sumatera [specimen examined by De Man (1880) and Tesch (1917) and identified as *punctatum*]. MALAYSIA: ZRC1965.8.3.38-39, 2 ♂ (16.2 x 13.0; 19.3 x 15.1 mm), Labuan, Sabah, coll. 1938; ZRC1964.9.8.14-19, ♂, 5 ♀ (not measured), Pulau Aor, M.W.F. Tweedie, 1950; ZRC1970.2.20.2, ♂ (not measured), Pulau Tioman, K. Romimohtarto, 1968; ZRC1991.351, ♀ (not measured), Tekek Bay, Pulau Tioman, P. Ng, 23.6.1983. SINGAPORE: ZRC1989 3670, ♂ (22.8 x 18.1 mm), Sungai Buloh mangroves, Singapore, P.K.L. Ng, 1986. HONG KONG: ZRC1975.6.30.15, ♂ (24.3 x 19.9 mm), Tai Tam, Hong Kong Island, C.L. Soh, 12.6.1975.

#### DESCRIPTION

*Carapace*. c.1.2-1.3 times broader than long (mean 1.25). Fronto-orbital width c.1.1 times carapace length. Depth c.0.7-0.75 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; slightly concave, with one anterolateral tooth behind the exorbital angle; second reduced to an angular projection only. Exorbital angle and first anterolateral tooth triangular and sharp; similar in size. Front c.0.52-0.55 times carapace width; c.0.59-0.64 times fronto-orbital width; moderately deflexed; weakly bilobed, almost straight; lateral angles obtuse, blunt. Post-frontal lobes without clumps of setae. Short ridge medially on first epibranchial tooth. Branchial ridges prominent; first relatively long; second arising from near lateral margin; 2-3 others also arise just inside lateral margin; last one forms strong ridge curving over base of last legs. Posterior margin c.0.47-0.51 times carapace width. Carapace surface smooth, shining, and minutely punctate. Setae arranged in scattered tufts on branchial lines, otherwise confined to posterolateral corners. Upper orbital border even-

ly microscopically granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.31-0.36 times width of front.

*Third maxilliped*. Merus c.0.9 times length of ischium. Suture between merus and ischium obliquely sloping inward. Ischium inner margin smooth or microscopically granular.

*Chelipeds*. Merus with posterior border minutely granulate; with blunt subdistal projection; lower border granulate, with small, triangular, subdistal spine; anterior border coarsely granulate but smooth on distal third; carpus with inner angle and inner margin granular, a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin with granular striations. Upper surface of palm defined anteriorly by a swollen longitudinal ridge. Outer surface of palm coarsely punctate, naked; without median longitudinal row. Inner surface of palm sparsely granular; with vertical row of 4-5 prominent granules behind gape, and 2-4 granules obliquely behind base of fixed finger. Immobile finger slightly flattened on outer surface; basally produced outward forming a prominent, elongate, triangular shelf over proximal three-quarters of finger, obliquely sloping outward. Length cutting edge c.0.41-0.44 times length propodus. Ventral border of chela convex. Dorsal surface of dactyl bearing 2 large, bluntly pointed, chitinous tipped tubercles on superior inner margin, similar size and shape, one medial, one near proximal end. Fingers pointed, lower finger with tip notched such that dactyl intermeshes; curved inwards; a moderate gape between cutting margins.

*Walking legs*. First three pairs all of similar length, c.1.5 times maximum carapace width. Merus of third leg c.1.8-2 times as long as wide. Carpus c.1.85-2.2 times as long as wide. Propodus c.1.4-1.65 times as long as wide. Dactyli c.1-1.2 times length of propodus. Carpi and propodi bear a short felt of setae on their upper halves, coverage less extensive on last legs; continues in thin rows onto dactyli.

*Male abdomen*. Width segment 3 c.4.3-4.6 times length. Segment 6 not elongated; 1.5-1.6 times wider than long. Telson slightly shorter than segment 6; 1.1-1.2 times longer than wide; evenly rounded.

*Gonopods*. G1 long, slender, curved. Inner-dorsal margin straight. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, rounded, calcified. Outer dorsal margin of stem

convex. Distal part of the stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae long, simple, lie around distal part of stem as for other species. G2 short, twisted.

*Sternum*. Sternum anterior to telson densely setose, setae continuing on the ischia of third maxillipeds.

#### COLOUR

'In life the carapace is dark purplish brown, irregularly marked with light brown near the posterior border. The legs are light brown with dark spots and the chelae bright red' (Tweedie, 1940: 109). 'In colour this species much resembles *Sesarma bidens*... the walking legs are, however, mottled with much larger and rounded reddish-violet blotches' (Tesch, 1918: 115, as *Sarmatium punctatum*). 'The chelae are bright red all over, the carpus and merus are red with dorsal patches of purple, and the carapace and legs are a dull purplish brown' (P. Ng, in litt.). A colour photograph of the specimen ZRC1991.351 has been published (Ng, 1986).

#### REMARKS

The dry specimen that I have designated the lectotype was not noted as a type in the Paris Museum, but it did have a label identifying it as coming from the Celebes, and collected by M. Riedel. It is the only specimen now in the Paris Museum that could be the type, however it also does not agree with the size of the specimen given by A. Milne Edwards (27 x 26 mm) which I consider to be in error as both the figure and all other specimens examined are considerably more broad than long. The possibility therefore must exist that A. Milne Edwards had several specimens at his disposal and that the specimen still existing is not the one specifically mentioned by A. Milne Edwards (1868). Because of this I am following ICZN Article 74b which notes that in cases where no original holotype was designated, and the amount of syntype material is uncertain, that a lectotype should be designated.

*Neosarmatium indicum*, *N. punctatum* and *N. malabaricum* have been very confused, and it is difficult to separate the records with certainty without examining all the material. *N. indicum*, although close to the latter two species, is very easily separated on the form of the claw, with its protruding basal shelf on the fixed finger of the cheliped of the male; and the lack of a strong tubercular vertical ridge on the inner face of the palm of the cheliped. It seems certain then that all

the material identified by Tweedie (1940, 1950 a,b) as *N. punctatum* is referable to *N. indicum* as the specimens of his examined for this study are all *N. indicum*. He stated in his 1940 paper that he identified his specimens from sketches of the type made by Dr I. Gordon, but these must not have shown the characteristic chela shape clearly. Soh's (1978) record of *N. punctatum* from Hong Kong was examined and it is certainly *N. indicum*. This is thus the northern-most confirmed record of any of these three species. There is an obscure record of *N. punctatum* from Kagoshima Prefecture in southern Japan, by Urita (1926) and re-cited in Sakai (1934) but not mentioned in Sakai's (1976) 'Crabs of Japan and the adjacent seas', and therefore its status must remain in doubt.

Thallwitz (1891) recorded *N. punctatum* from Manado in northern Celebes (Sulawesi) which is the type locality for *N. indicum*. He particularly noted the row of granules on the inside of the palm of the cheliped which is a characteristic of *N. punctatum*, and this suggests that his identification was correct, however there is still some doubt as one large male of *N. indicum* examined (NNMD187) has a distinct row of granules on the inner face of the palm which, although not nearly as strong as on *N. punctatum*, may have been what Thallwitz described.

#### HABITAT

'In deep holes in the banks of a small stream near its entry into the sea and could only be collected at night; even then they were wary and difficult to catch' (Tweedie, 1940: 109). From a brackish swamp (Tweedie, 1950b). 'In a freshwater stream not subjected to any tidal influence and without real mangroves about. It looked typically freshwater' (P. Ng, in litt.)

#### DISTRIBUTION

Only confirmed from the following localities. Celebes (Sulawesi) (type locality: A. Milne Edwards, 1868b) - Aor and Tioman Islands, Malaysia, South China Sea (Tweedie, 1940; present record) - Labuan, Sabah, Borneo (Tweedie, 1950a) - Hong Kong (Soh, 1978; present identification) - Singapore (present record) - Padang on the southwestern coast of Sumatera, Indian Ocean (Tesch, 1917, 1918, as *S. punctatum*).

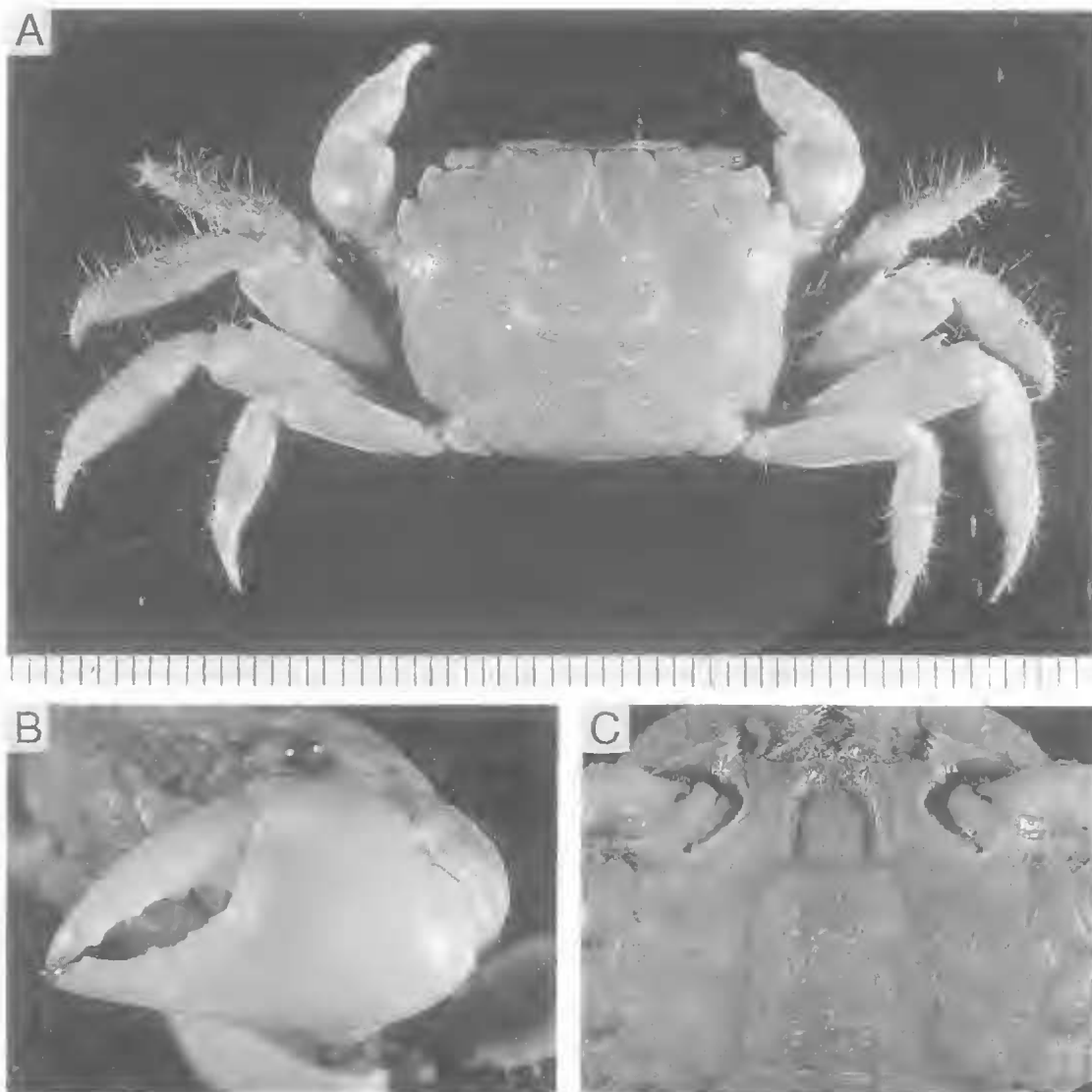


FIG. 5. *Neosarmatium inerme* (De Man, 1887), ♂, ZMH4080. A, dorsal view; B, chela; C, sternum and male abdomen. Scale line in mm.

***Neosarmatium inerme*** (De Man, 1887)  
(Figs 1C, D; 5; 15A, C, E; 16)

*Sarmatium inerme* De Man, 1887: 660, 687; Tesch, 1917: 221.

*Neosarmatium inermis*: Serène & Soh, 1970: 398, 405.

**TYPE INFORMATION**

Lectotype, here designated, ♂ (20.6 x 17.9 mm), MNHN-B3629; paralectotype, ♂ (20.6 x

18.9 mm), same registration. Type locality: Paulo [=Pulau] Condor [now Con Son], Vietnam.

**MATERIAL EXAMINED**

SYNTYPES: MNHN-B3629, 2♂ (20.6 x 17.9; 20.6 x 18.9 mm), Con Son, Vietnam, South China Sea.

OTHER MATERIAL: ZMH-K4080, 8♀ (17.5 x 14.2; 16.9 x 13.6; 17.8 x 14.5mm; 17.7 x 14.7; 19.1 x 15.5; 18.6 x 15.1; 20.3 x 16.4mm), 3♂ (13.9 x 11.8; 18.5 x 15.0mm; one unmeasured), Saigon River, Saigon, Vietnam, Capt. W. Schwinghammer, 18.10.1908.

## DESCRIPTION

**Carapace.** 1.1-1.24 (mean 1.22) times broader than long. Fronto-orbital width c.1-1.1 times carapace length. Depth c.0.75-0.8 times carapace width in adults, less in small specimens. Cardiac region distinct. Lateral margins subparallel or slightly divergent; almost straight, or slightly concave. Anterolateral margins with two teeth behind the exorbital angle. Exorbital angle and first anterolateral tooth triangular and pointed; similar in size. Second anterolateral tooth blunt; much smaller than first. Front c.0.5 times carapace width; 0.53-0.59 times fronto-orbital width (mean 0.56); moderately deflexed; with deep, broad median emargination; lateral margins slightly diverging posteriorly. Post-frontal lobes without clumps of setae. Ridge medially on first anterolateral tooth. Branchial ridges more-or-less prominent; first follows from posterior edge of last epibranchial tooth, relatively short; followed by a series of short broken granular striations, except for last which forms strong ridge continuing over base of last legs. Posterior margin c.0.5 times carapace width (one specimen aberrant at 0.6). Carapace surface smooth, shining, punctate; setae arranged sparsely on branchial lines, mainly confined to posterolateral branchial regions. Upper orbital border evenly, minutely, granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.29-0.33 times width of front.

**Third maxilliped.** Suture between merus and ischium obliquely sloping slightly inward. Ischium inner margin smooth or microscopically granular.

**Chelipeds.** Merus with posterior border minutely finely striated; with blunt subdistal projection; lower border granulate, without subdistal spine; anterior border coarsely granulate, but smooth on distal third; carpus with inner angle rounded and granulate; inner margin granular, a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm sometimes with a longitudinal ridge slightly indicated; otherwise smooth. Outer surface of palm smooth, naked, with minute smooth flat granules; with more-or-less discernible median longitudinal row. Inner surface of palm granular mesially; with a vertical row of larger granules but not elevated into a crest. Immovable finger rounded on outer surface; moderately long, length cutting edge c.0.43-0.44 times length propodus. Ventral border of chela straight to

slightly convex. Dorsal surface of dactyl smooth, rounded. Fingers pointed, lower finger notched behind tip so that dactyl intermeshes, curved inwards, a moderate gape between cutting margins.

**Walking legs.** Second and third pairs sub-equal and slightly longer than others, c.1.8 times maximum carapace width. Merus of third leg c.2.6-2.7 times as long as wide. Carpus c.2.3-2.7 times as long as wide. Propodus c.2-2.5 times as long as wide. Dactyli c.1-1.1 times length of propodus. Upper margins of meri granular, sometimes with some sharp spinules; posterior margins finely granular. Carpi and propodi bear a short felt of setae on upper and lower faces, more-or-less covering anterior face of first two pairs, less so on last two pairs.

**Male abdomen.** Male abdomen not remarkably elongate; moderately broad; segment 3 the widest, first three segments of similar width. Width segment 3 c.5.1-5.5 times length. Segment 6 not elongated, 1.75-1.85 times wider than long. Telson longer than preceding segments; 1.1-1.15 times longer than wide; evenly rounded.

**Gonopods.** G1 moderately stout; slightly curved. Inner-dorsal margin slightly curved. Dorsal surface of stem flattened; completely calcified. Palp absent, position indicated by a slight expansion of inner dorsal margin. Outer dorsal margin of stem moderately convex. Distal part of the stem broad. G1 apical process corneous; moderately produced; straight. Gonopore terminal. Setae long; feathered. G2 short, slender, tapering, moderately twisted.

**Sternum.** Sternum anterior to telson densely setose, setae continuing on the ischia of third maxillipeds.

## REMARKS

*Neosarmatium inerme* and the closely related *N. spinicarpus* sp. nov. are aberrant within *Neosarmatium* by having more slender walking legs and by the much shorter, stockier male first pleopod, which has the distal portion short, not strongly narrowed, and only slightly twisted compared with other *Neosarmatium* species. These characters are possibly sufficient to warrant removal from *Neosarmatium* but as the allied genera remain to be revised no action is being taken at this time.

## HABITAT

Not recorded.

## DISTRIBUTION

Known from Con Son (type locality), and

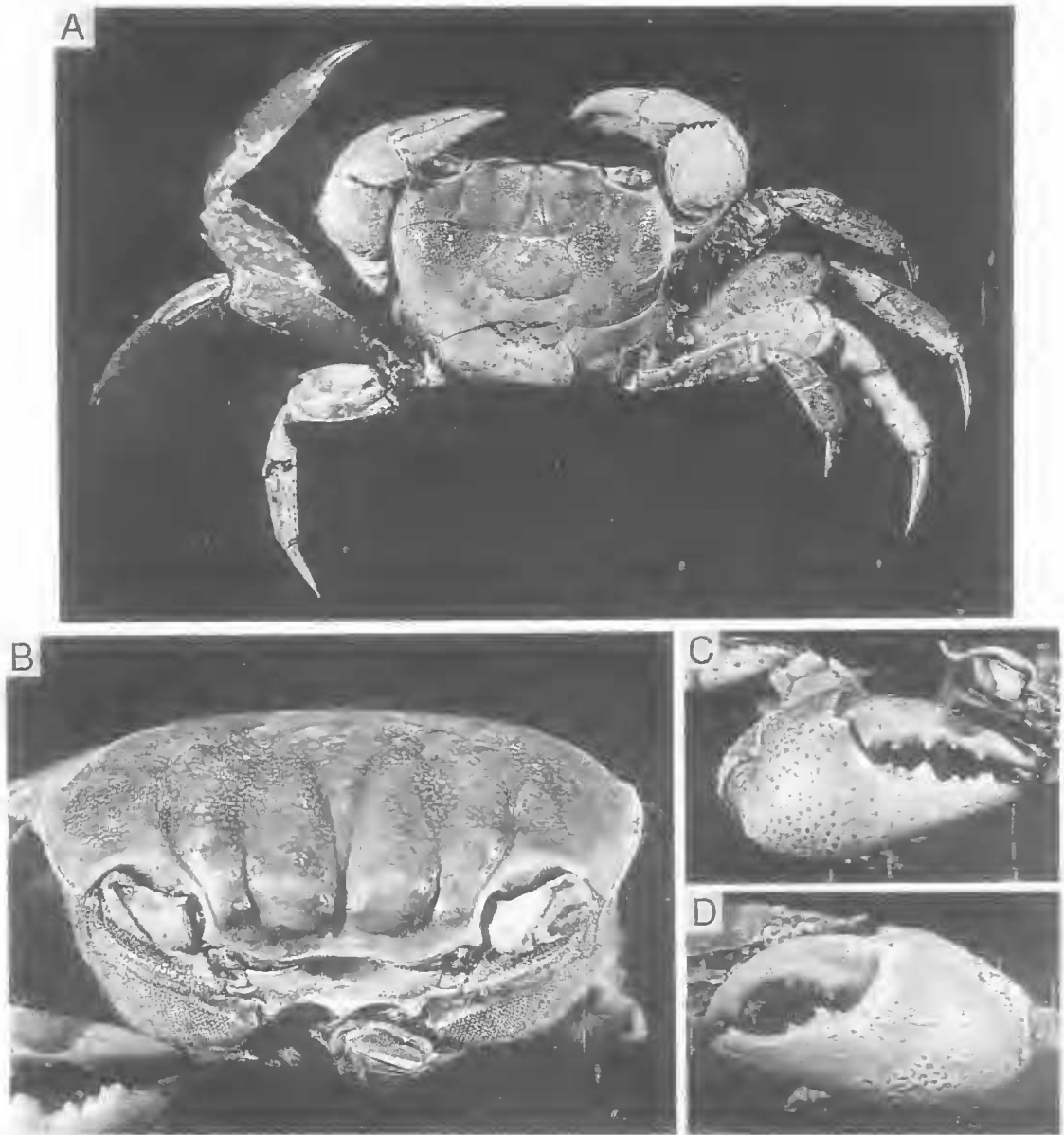


FIG. 6. *Neosarmatium integrum* (A. Milne Edwards, 1873). A-C, paralectotype ♀ (34.6mm carapace breadth); D, lectotype ♀. A, dorsal view; B, frontal margin; C, right chela D, left chela.

Saigon, Vietnam, South China Sea (present record).

*Neosarmatium integrum* (A. Milne Edwards, 1873)  
(Figs 6, 7, 18)

*Metagrapsus integer* A. Milne Edwards, 1873: 309, pl. 17, fig. 3.

*Sarmatium integrum*: De Man, 1887: 660; Tesch, 1917: 221.

*Sarmatium birói* Nobili, 1905: 498-501, text-fig. 2; Tesch, 1917: 213-214 (no specimen).

*Neosarmatium birói*: Serène & Soh, 1970: 398, 406 (in list); Forró & Müller, 1985: 78, figs 4-8.

*Neosarmatium integrum*: Serène & Soh, 1970: 398, 405.

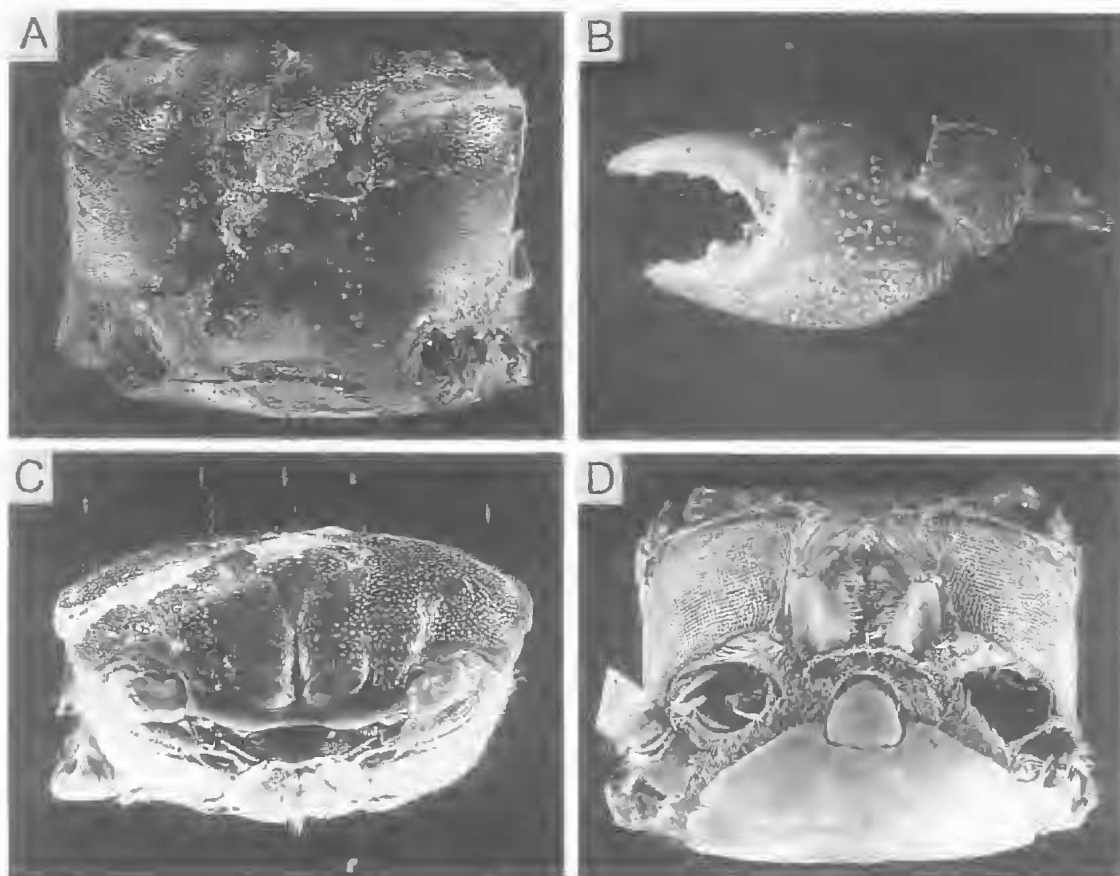


FIG. 7. *Neosarmatium integrum* (A. Milne Edwards, 1873), ♀, holotype of *Neosarmatium biroi* (Nobili, 1905). A, dorsal view; B, left cheliped; C, frontal margin; D, ventral view.

#### TYPE INFORMATION

Lectotype here designated, ♀ (39.0 x 30.8 mm), paralectotype, ♀ (34.6 x 27.5 mm), MNHN-B3628. Type locality: New Caledonia.

*N. biroi*: Holotype, Hungarian Natural History Museum, Budapest, Hungary. Type locality: Stephansort, Astrolabe Bay, NE Papua New Guinea.

#### MATERIAL EXAMINED

TYPES: MNHN-B3628, 2 ♀ (34.6 x 27.5; 39.0 x 30.8 mm), New Caledonia, coll. M. Balansa. The larger female corresponds to the measurements given by A. Milne Edwards (1873) and is designated the lectotype.

OTHER MATERIAL: QMW19557, ♀ (31.7 x 25.7 mm), Ngela Is., Solomon Islands, 17.12.1976.

#### DESCRIPTION

*Carapace*. c.1.25 times broader than long. Fronto-orbital width c.1.06 times carapace length. Depth c.0.7 times carapace width. Lateral

margins slightly convergent posteriorly; sinuous. Anterolateral margins regularly convex; without teeth, but typical position of first tooth slightly indicated. Exorbital angle triangular. Front c.0.45 times carapace width; c.0.54 times fronto-orbital width; lateral angles obtuse; lateral margins diverging posteriorly. Post-frontal lobes distinct; median lobes distinctly broader than laterals; laterals distinctly separated from inner orbital margin. Branchial ridges moderately prominent; first arising from position where last epibranchial tooth should be, relatively long; second arising from near lateral margin.

Posterior margin c.0.45-0.5 times carapace width. Carapace surface smooth, shining, punctate, without marked setation. Upper orbital border smooth; straight and oblique. Lower orbital border straight; evenly granular. Inter-antennular septum moderately narrow, c.0.3 times width of front.

*Third maxilliped*. Suture between merus and

ischium horizontal. Accurate measurements not possible on dry types.

*Chelipeds.* Merus with posterior border minutely striated; without distinct subdistal spine; lower border granulate; anterior border coarsely granulate mesially; carpus with inner angle granular; inner margin granular, with a secondary ventral granular ridge bearing tuft of long setae proximally; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm not defined anteriorly by a longitudinal ridge. Outer surface of palm punctate, naked; usually with median longitudinal row. Inner surface of palm with low granular vertical crest and patch of granules ventro-proximally, otherwise smooth. Immobile finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.5 times length propodus. Ventral border of chela straight. Dorsal surface of dactyl tuberculate; on female appear to be 4 or 5 forwardly directed tubercles over proximal three-fifths of inner dorsal margin, largest proximally, evenly spaced, with chitinous tips on distal tubercles - these could be expected to be stronger and more prominent on males. Fingers pointed; curved slightly inwards; narrow gape between cutting margins (probable that males would have larger gape).

*Walking legs.* Second pair slightly the longest; c.1.6 times maximum carapace width. Merus of third leg c.2.4-2.5 times as long as wide. Carpus c.2.4-2.7 times as long as wide. Propodus c.2.3-2.5 times as long as wide. Dactyli c.0.9-1.0 times length of propodus. Carpi and propodi bear a short felt of setae on anterior surfaces and on ventral faces of first three pairs; restricted to a thin band on anterior surface of fourth pair; felt extends onto and encircles dactyli in 6 thin lines.

#### COLOUR

Purple, with the borders of the carapace, the chelipeds, and the walking legs becoming reddish (A. Milne Edwards, 1873).

#### REMARKS

This species is easily distinguished by the lack of strongly defined epibranchial teeth. The first epibranchial tooth is only slightly indicated on the lectotype and paralectotype, is small but visible on the specimen from the Solomon Islands, and is better developed on the holotype of *N. biroi* but still lacks the fissure in the anterolateral margin that is typical of other species. The distinct first epibranchial tooth seems to be the major character that separates *N.*

*biroi* from *N. integrum*, however as there are so few specimens available, and the specimen from the Solomon Islands is intermediate in development I am inclined to believe that this character is subject to some individual variation. Despite the fact that all specimens are female and therefore do not show strong chela features, there seems to be no differences in shape or dentition of the chelae between *N. biroi* and *N. integrum*. Nobili (1905) described the meri of legs 1-3, of *N. biroi*, as having the distal third of their posterior border minutely denticulate, and on the Solomon Islands specimen there are also a few small denticles distally on legs 1 and 2. It is still possible that *N. biroi* will prove to be a valid species, however I do not believe it can be reliably separated from *N. integrum* at this time, and feel that until a good series of male and female specimens are available from several localities, it is best to place it into the synonymy of *N. integrum*.

The holotype of *N. biroi* is a poorly preserved dry female with disarticulated limbs (Forró & Müller, 1985), and therefore it could not be loaned for study. The photographs of the holotype are published here through the kindness of Dr László Forró.

The male is so far not known.

#### HABITAT

In the mangrove forest (A. Milne Edwards, 1873).

#### DISTRIBUTION

New Caledonia (type locality of *N. integrum*); Solomon Islands (present record); northern coast of Papua New Guinea (*N. biroi*).

*Neosarmatium laeve* (A. Milne Edwards, 1869)  
(Figs 1A, B; 8; 17)

*Sesarma laeve* A. Milne Edwards, 1869: 27.

*Sesarma laevis*: De Man, 1887: 649; 1892: 333 (note on type-specimen in the description of *Sesarma moeschii*).

*Sesarma* (*Sesarma*) *aequifrons* Rathbun, 1914: 76; Tesch, 1917: 129.

*Sesarma* (*Sesarma*) *laevis*: Tesch, 1917: 164.

*Neosesarma laevis*: Serène & Soh, 1970: 395, 405.

*Neosesarma aequifrons*: Serène & Soh, 1970: 395, 405 (in list).

*Neosarmatium aequifrons*: Serène, 1977b: 758-59, figs 62-64; Haig, 1984: 127.



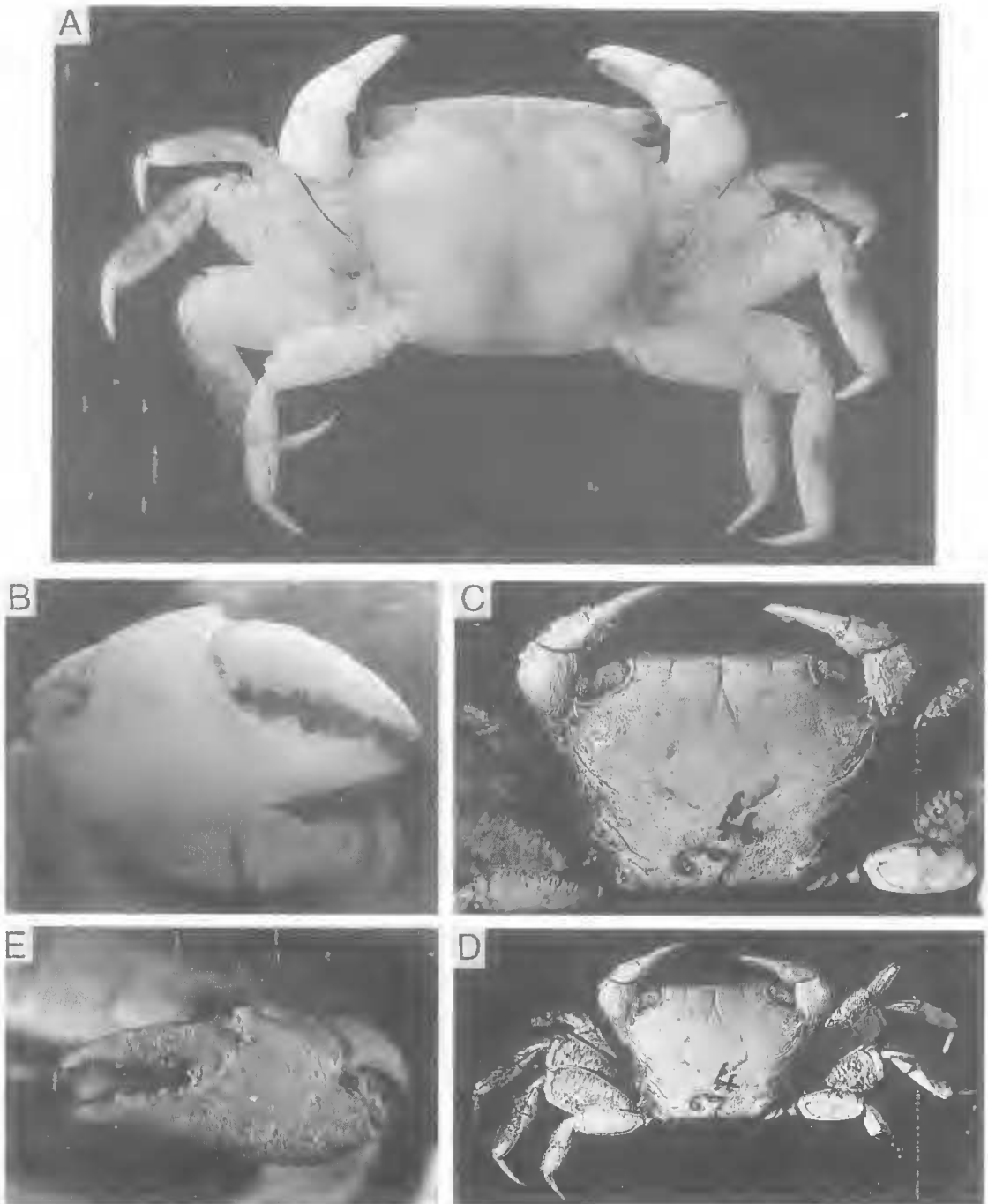


FIG. 8. *Neosarmatium laeve* (A. Milne Edwards, 1869). A, B, holotype of *N. aequifrons* (Rathbun, 1914); C-E, holotype of *N. laeve*. A, C, D, dorsal views; B, right chela; E, left chela.

*Neosarmatium ambonensis* Serène & Moosa, 1971: 12, pl. 5C, D.

#### TYPE INFORMATION

*N. laeve*: holotype, MNHN-3964, Paris. Type locality: Aru Island, southeastern Indonesia.

*N. aequifrons*: holotype, USNM45754, Washington. Type locality: Pangaman River, Port Colton, Busuanga Island, Philippines.

*N. ambonensis*: holotype, Institute of Marine Research of Indonesia, Djakarta. Type locality: Ambon, Indonesia.

#### MATERIAL EXAMINED

USNM45754, *N. aequifrons* holotype ♂ (11.4 x 9.0 mm), paratype ♀ (10.7 x 8.3 mm), Pangaman River, Port Colton, Busuanga Island, Philippines, 15.12.1908, U.S. Bureau of Fisheries, Albatross Philippine Expedition of 1907-09; QMW19555, 2 ♂ (10.9 x 8.7; 11.3 x 9.1 mm), Nggela Is., Solomon Islands, 17.9.1976.

#### DIAGNOSIS

(Modified after Serène & Moosa, 1971).

Carapace smooth and punctate, c.1.25 times broader than long. Lateral margins sub-parallel, or slightly convergent; a single prominent epi-branchial tooth, second reduced to a trace. Frontal border nearly straight, almost two-thirds carapace width; postfrontal lobes faintly indicated. Posterior border straight and narrower than front. Maximum carapace width across epi-branchial teeth. Inner surface of palm of male cheliped with prominent vertical granular crest; outer edge of upper border of palm with finely granular longitudinal rim; superior margin of dactyl with 4 low, distally directed, tubercles, a moderate gape between fingers of mature males. Meri of walking legs broad, anterior borders convex, with acute subdistal spine; short transverse striae; carpi and propodi with dense covering of short setae above lateral accessory carinae. Male abdomen with telson as long as broad at base; segment 6 slightly shorter than telson, and exactly twice as broad (at base) as long.

#### REMARKS

Although I have not examined the types of *N. ambonensis* and *N. laeve*, I have little doubt of the correctness of the new synonymy presented here. Serène (1977) recognised that *N. ambonensis* and *N. aequifrons* were synonyms. Serène & Soh (1970) had placed *N. aequifrons*, and tentatively, the poorly known *N. laeve*, into their new genus *Neosesarma*. The differences in dentition of the dactyl of the cheliped between *Neosarmatium*

and *Neosesarma* are enough however to exclude *N. laeve* from the latter genus. Comparisons of the photographs of the holotypes of *N. aequifrons* (Fig. 8A, B), *N. laeve* (Fig. 8C-E), and *N. ambonensis* (Serène & Moosa, 1971, pl. 5 C, D) show no points of difference. Unfortunately the type of *N. laeve* is immature, and the diagnostic chela characters are not clear; this has no doubt been the cause of its uncertain taxonomic position. The close geographical proximity of the respective type localities further supports the synonymy presented here.

This is one of the smallest of the species of *Neosarmatium*. It is unusual in the genus by being relatively quadrate, with the anterolateral margins not markedly convex, and the carapace being not as deep as in other species. In all other major respects however, there seems no cause to exclude it from the genus. It can be separated from its congeners using the characters presented in the key.

#### HABITAT

Not recorded.

#### DISTRIBUTION

From Busuanga Is., in the Philippines, south to Ambon and Aru Islands, in eastern Indonesia; Solomon Islands (present record); and in the Indian Ocean, from Mahé, Seychelles (Serène, 1977b).

#### *Neosarmatium malabaricum* (Henderson, 1893)

(Figs 1G, H; 9A, B; 17)

*Sesarma indica*: Heller, 1865: 64 (in part, the specimens from Ceylon) [Not *Sesarma indicum* H. Milne Edwards, 1837 (= *Thomomium indicum*)].

*Sarmatium indicum malabaricum* Henderson, 1893: 393, pl. 36, fig. 17; Tesch, 1917: 220 (no specimen).

*Sarmatium punctatum*: Thallwitz, 1891: 41, not seen [? = *N. indicum* - not *Metagrapsus punctatus* A. Milne Edwards, 1873 = *Neosarmatium punctatum*].

? *Sarmatium indicum*: Nobili, 1903: 23.

*Sesarma* (*Sarmatium*) *punctatum*: Pillai, 1951: 37 [? = *N. indicum*].

*Neosarmatium indicum malabaricum* Serène & Soh, 1970: 398, 405 (in list).

*Neosarmatium malabaricum*: Serène, 1975: 4-13, pls 1, 2, 3A, B.

#### TYPE INFORMATION

Lectotype, BMNH 1892.7.15.242, designated

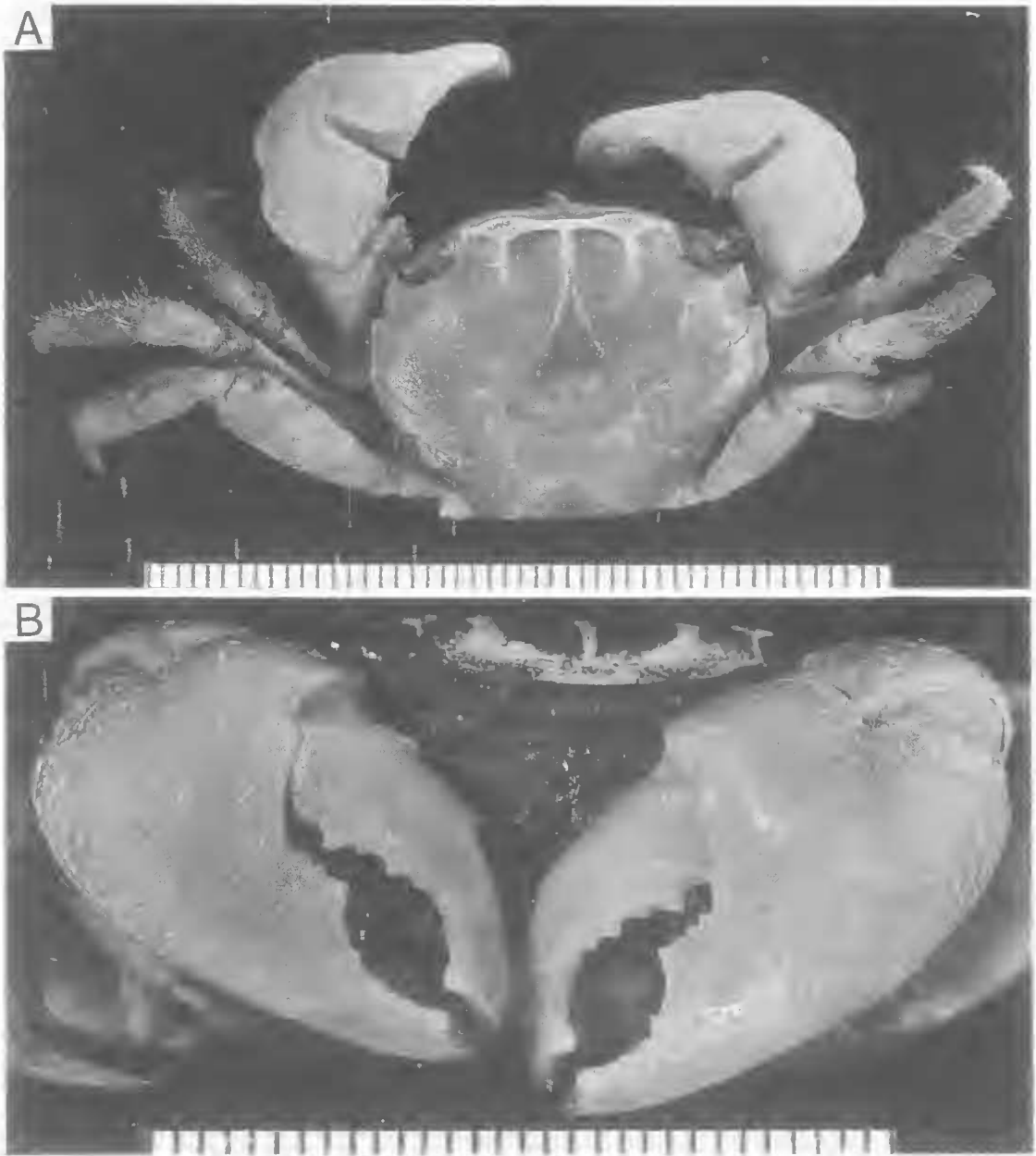


FIG. 9. *Neosarmatium malabaricum* (Henderson, 1893), ♂ syntype, BMNH1892.7.15.242-5. A, dorsal view; B, frontal view. Scale line in mm.

Serène (1975). Type locality: Cochin, Malabar Coast of India.

24.3mm), ♀ (26.7 x 22.0mm), Colombo, Sri Lanka, R. Serène, 12.10.1972.

#### MATERIAL EXAMINED

MNHN-B10461, 1 ♂ (22.5 x 19.0mm), mangrove near Pegasus Reef Hotel, Colombo, Sri Lanka, R. Serène, 11.10.1972; MNHN unreg., 6 ♂ (21.5 x 18.1; 22.7 x 18.8; 23.8 x 19.3; 26.2 x 21.5; 29.7 x 24.3; 30.9 x

#### DESCRIPTION

*Carapace*. c.1.2 times broader than long. Fronto-orbital width c.1.1 times carapace length. Depth c.0.75 times carapace width. Cardiac region distinct; Lateral margins subparallel;

slightly concave. Exorbital angle triangular and sharp. First anterolateral tooth triangular and blunt; similar in size to exorbital angle. Second anterolateral tooth an angular projection only. Front c.0.6 times fronto-orbital width; strongly vertically deflexed, not visible from above; with shallow median emargination; lateral angles bluntly acute; slight pre-orbital concavity; lateral margins concave. Post-frontal lobes without clumps of setae. Epi-branchial ridges run inwards from each anterolateral tooth; short ridge medially on first epibranchial tooth. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively short; others arise just inside lateral margin; a strong ridge curving over base of last leg. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate. Setae arranged sparsely on branchial lines. Upper orbital border smooth to microscopically granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.36 times width of front.

*Third maxilliped.* Suture between merus and ischium horizontal. Ischium inner margin smooth. Exopod narrow, not much visible in frontal view; 0.4-0.5 times width of ischium.

*Chelipeds.* Merus with posterior border with minute granular striations; lower border granulate; anterior border convex coarsely granulate; carpus with inner angle granular; inner margin unarmed; a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm defined anteriorly by a swollen longitudinal ridge; posteriorly by uneven granular rim with some larger granules distally. Outer surface of palm naked, punctate proximally-ventrally, with short oblique granular striations; with indistinct median longitudinal row. Inner surface of palm sparsely granular; with a strongly raised granular vertical crest, and a secondary, lower, oblique granular crest running onto base of fixed finger. Immobile finger rounded on outer surface; moderately long, length cutting edge c.0.47 times length propodus. Ventral border of chela straight below fixed finger. Dorsal surface of dactyl bearing 2 large, acute, chitinous tipped tubercles on superior inner margin, similar size and shape, one medial, one proximal. Fingers pointed, lower finger with tip notched, such that dactyl is intermeshing; curved slightly inwards; a wide gape between cutting margins.

*Walking legs.* First three pairs all of similar length, second slightly the longer, c.1.6 times

maximum carapace width. Merus of third leg c.2.1 times as long as wide. Carpus c.2.1 times as long as wide. Propodus c.1.7 times as long as wide. Dactyli about equal to length of propodi, or slightly longer than propodi. Carpi and propodi bear a short felt of setae on both dorsal and ventral surfaces of legs 1-3, above the accessory carinae on the carpi and almost encircling the propodi distally; this felt only on dorsal surface of fourth leg; felt continues in thin rows onto the dactyli.

*Male abdomen.* Width segment 3 c.4 times length. Segment 6 slightly elongated, c.1.6 times wider than long. Telson subequal to segment 6, both longer than preceding segments; c.1.1 times longer than wide; evenly rounded.

*Gonopods.* G1 relatively slender. Inner-dorsal margin distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem straight. Distal part of the stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae long, simple, lie along apical process and on palp obscuring structural detail. G2 short; evenly curved, twisted.

#### COLOUR

'Live specimens are dark brown with a violet tinge, especially on the carapace' (Pillai, 1951: 37).

#### REMARKS

The present specimen was compared with photographs of the holotype in the British Museum. They are identical. See remarks under *N. indicum* for discussion of points of separation from that species and from *N. punctatum*.

#### HABITAT

Serène (1975) noted that in Sri Lanka it is similar to *N. meinerti* in that it lives in the rearward mangrove zone around the houses, and in the grass platform around the coconut trees; also they dig deep holes but do not construct mounds. Pinto (1984) observed that it was crepuscular, colonised the drier soils, and made T-shaped burrows which bifurcate shortly after their origin. Around the Vembanad Lake, in Southern India, Pillai (1951, as *Sesarma punctatum*) said that it shows a preference for muddy regions where it burrows in loose dark mud close to the waterline.

#### DISTRIBUTION

Cochin, Malabar Coast, India (type locality);

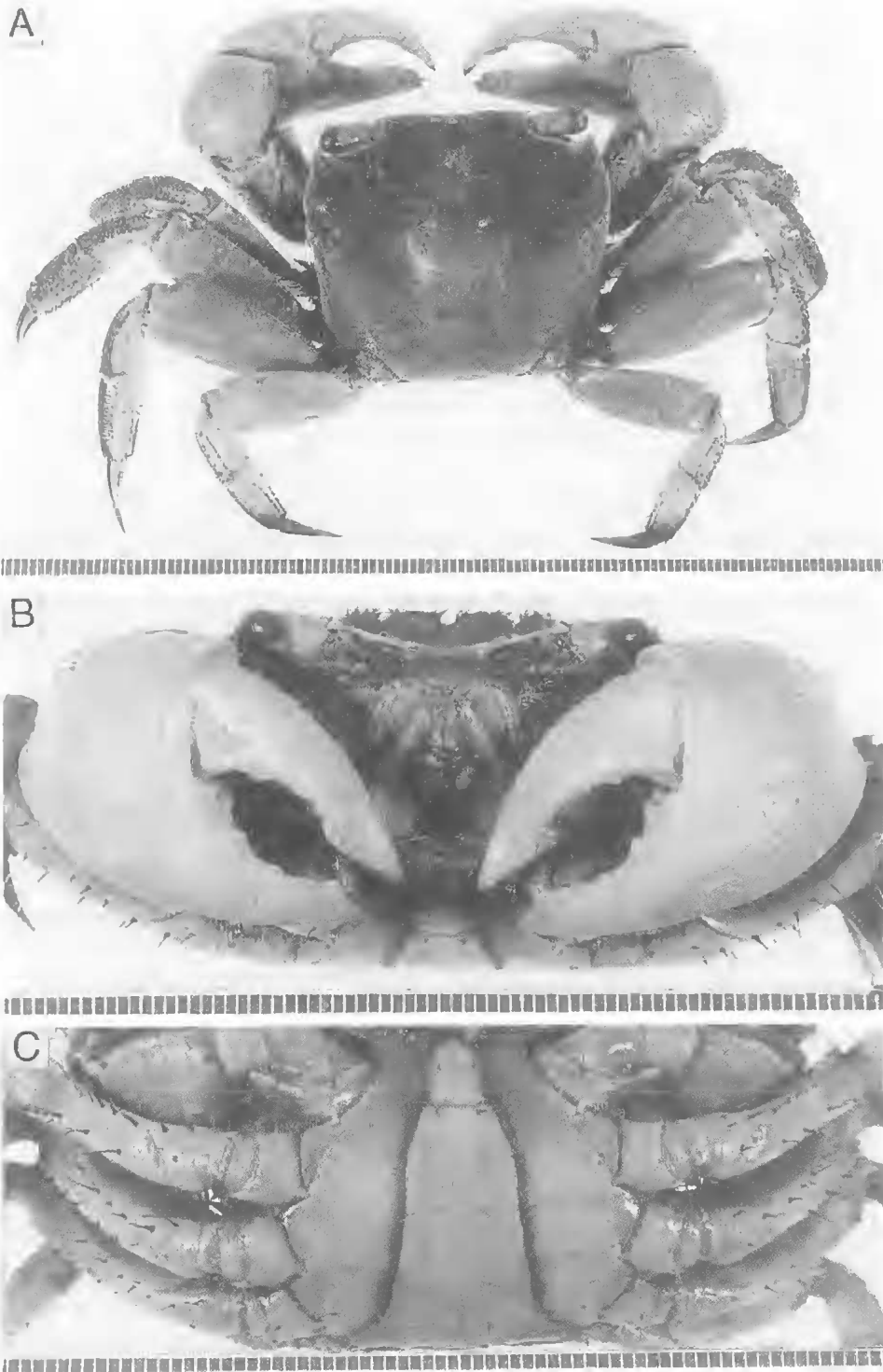


FIG. 10. *Neosarmatium meinerti* (De Man, 1887), ♂, AMP11213. A, dorsal view; B, frontal view; C, ventral view of abdomen and sternum. Scale line in mm.

Ceylon (Serène 1975; and present record). Also almost certainly from the Vembanad Lake, Southern India (Pillai, 1951); Seychelles (Nobili, 1903); Nicobars (Heller, 1865).

***Neosarmatium meinerti* (De Man, 1887)**  
(Figs 2E-G; 10; 16)

*Sesarma tetragona*: H. Milne Edwards, 1837: 73; 1853: 184-185; Krauss, 1843: 44; Hilgendorf, 1869: 90, pl. 3, fig. 3d; 1879: 809; A. Milne Edwards, 1868a: 71; Hoffmann, 1874: 23; Lenz & Richters, 1881: 425; Henderson, 1893: 392 [not *Cancer tetragona* Fabricius, 1798: 341].

*Sesarma africana*? Bianconi, 1869: 341 [fide Hilgendorf, 1879: 809; Tesch, 1917: 171].

*Sesarma tetragonum*: Miers, 1879: 490; Stebbing, 1910: 321; 1917a: 438; 1917b: 10.

*Sesarma rotundifrons*: De Man, 1880: 24 [not *Sesarma rotundifrons* A. Milne Edwards, 1869].

*Sesarma meinerti* De Man, 1887: 648, 668-69; Pfeffer, 1889: 31; Bürger, 1893: 617; Ortmann, 1894a: 720; 1894b: 56; Alcock, 1900: 417; Doflein, 1904: 130; Lenz, 1905: 372; Gravier, 1920: 472; Cott, 1930: 679-92, pl. 1; Horikawa, 1940: 30; Lin, 1949: 30; Fourmanoir, 1953: 89; 1954: 5; Haig, 1984: 127.

*Sesarma (Sesarma) meinerti*: Tesch, 1917: 171-174, 246; Chace, 1942: 201; 1953: 441; Miyake, 1938: 108; Barnard, 1950: 125-26, fig. 25c-f; Crosnier, 1965: 61, figs 81, 90, 91, 96, 103.

*Sesarma (Episesarma) meinerti*: De Man, 1895: 166.

*Sesarma (Sarmatium) meinerti*: De Man, 1929, fig. 4 (in part).

*Neosarmatium meinerti*: Serène & Soh, 1970: 398, 406 (in list); Serène, 1973: 127-129, pl. 4 A-C; 1977a: 51; Dai et al., 1986: 496, fig. 280, pl. 70(3); Dai & Yang, 1991: 543-44, fig. 280, pl. 70(3).

**TYPE INFORMATION**

Holotype unidentifiable (see Remarks). Type locality: Isle de France (= Mauritius).

**MATERIAL EXAMINED**

**SOUTH AFRICA**: QMW8835, 3♂ (41.3 x 35.7; 42.2 x 36.2; 45.7 x 39.0mm), 1♀ (30.5 x 25.6mm), 7.5.1964, W. Macnae; QMW8877, 2♂ (46.7 x 38.1; 37.5 x 32.7mm), 7.8.1964, W. Macnae; QMW8878, 5♂, 3♀ (27.0 x 22.2 - 42.3 x 35.7mm), South Africa, 7.8.1964, W. Macnae. **MADAGASCAR**: MNHN-B16735, 2♂ (42.8 x 34.8; 40.2 x 33.4mm), 3 ovig. ♀ (34.4 x 28.9; 37.9 x 31.4; 38.9 x 32.3mm), Nosy-Be, A. Crosnier. **MAURITIUS**: NNM17503, ♂ (27.1 x 22.4mm), Fort Barkly, Port Louis, Mauritius, C. Michel, Feb. 1960. **AUSTRALIA**: ZMH Unreg., 2♂ (35.0 x 29.0; 39.5 x 33.3mm), Crab Creek, 14 miles

east of Broome, W. Australia, G. Hartman, 11.9.1975; AMP11213, ♂ (38.2 x 32.7mm), ♀ (40.2 x 33.2mm), Melville Bay and Cape Arnhem area, NT, no date or collector information; QMW9077, ♂ (46.2 x 37.9mm), Nungbalgarri Ck., 10 km upstream Rolling Bay, NT, 11°59'S, 133°59'E, Aug. 1975, D. Grace, *Cerriops* forest, mudfloor, caught in pipe trap; QMW9076, ♂ (45.2 x 38.5mm), Ngandauda Ck., Boucaut Bay, NT, 12°05'S, 134°43'E, 8.9.1975, D. Grace, 20.5 kms upstream, west bank, *Avicennia* forest, mudfloor, burrows; QMW9074, ♂ (42.9 x 36.1mm), Hutchinson Strait, Buckingham Bay, NT, 12°15'S, 135°19'E, 24.Sep.1975, D. Grace, upper reaches Ck. A., *Cerriops* thicket, burrows; QMW9075, 2♀ (47.5 x 39.6; 39.8 x 33.3mm), Glyde R., Buckingham Bay, NT, 12°17'S, 135°02'E, 14.9.1975, D. Grace, 5 kms upstream, east bank *Avicennia/Cerriops* mudfloor, burrows; QMW9072, 2♂ (43.0 x 37.2; 44.0 x 37.0mm), Glyde River, Buckingham Bay, NT, 12°S, 135°E, 12.9.1975, D. Grace, 15 kms upstream, west bank, *Avicennia/Cerriops* mudfloor, burrows; QMW9073, ♀ (43.3 x 35.5mm), Glyde River, Buckingham Bay, NT, 12°21'S, 135°02'E, 14.9.1975, D. Grace, 30 km upstream, east bank, *Brugieta/Cerriops* forest, burrows; QMW8837, ♂ (48.4 x 41.6mm), Buckingham River, NT, 12°31'S, 135°43'E, 29.9.1975, burrow in mud-bank below *Cerriops*; QMW8836, ♂ (44.9 x 38.4mm), Mornington Island, NT, 16°36'S, 139°21'E, Dec. 1976, J. Covacevich; NTM Unreg., ♂ (38.4mm c.b.), Stn HC/4, MacArthur R., Gulf of Carpentaria, R. Hanley, NTM Cr Unreg., ♀ (40.0mm c.b.), Stn PC/T5, MacArthur R., Gulf of Carpentaria, R. Hanley.

**DIAGNOSIS**

Carapace smooth, shining, punctate, bearing short setae in tufts; c. 1.2 (1.5-1.23) times broader than long. Lateral margins slightly convergent posteriorly; a single prominent epibranchial tooth, second tooth present but reduced to a trace; greatest carapace width between middle of first epibranchial teeth. Frontal border slightly sinuous with a shallow median concavity, approximately half carapace width; postfrontal lobes strongly indicated. Posterior border straight; width variable, usually less than frontal width in males, but may be subequal or wider in females. Merus of cheliped without subdistal tooth developed on posterior margin. Inner surface of palm of male cheliped with a vertical crest consisting of a single row of large tubercles; outer surface without sub-median, horizontal crest; outer edge of upper border of palm without obvious longitudinal rim; ventral border of chela broadly convex; superior margin of dactyl with a single row of uniform sized, evenly spaced,

chitinous tubercles; a broad gape between fingers of mature males. Meri of walking legs broad (merus of third pair c.2.5 times longer than wide), anterior borders slightly convex, with acute subdistal spine, dorsal face with short transverse striae; carpi and propodi with dense covering of short setae around superior margin. Male abdomen narrow; telson slightly longer than broad at base; segment 6 elongated, c.1.6 times longer than telson, and c.1.1 times broader (at base) than long.

#### COLOUR

'*S. meinerti* is an extremely handsome beast. Above, the carapace is dark purple anteriorly, passing into a beautiful deep violet posteriorly, and having the anterior and lateral margins narrowly bordered with orange; the under surfaces are mauve and ochre. The walking legs are purple dorsally, with an orange spot around the hinge-like articulations between the joints, and pale yellow beneath. ... The proximal joints [of the chelipeds] are pale yellow, the merus bright orange, the wide and conspicuous carpus and the proximal region of the propodus and dactylus being a brilliant red, intermediate in tone between vermilion and orange. Beneath the chelipeds are yellow' (Cott, 1930: 682-83).

It appears that the intensity and predominant colour of this species changes through its range. In the Northern Territory, Australia, I have found two colour morphs living sympatrically. The 'orange form' has predominantly orange chelipeds, with the palm being orange over the proximal half, fading to yellow distally, the fingers being mainly yellow; the carapace has a reddish-orange undertone, and reddish-orange anterolateral margins. The 'yellow form' has the chelipeds a uniform dirty pale yellow; the carapace is steel-gray but with a yellowish undertone, the yellow being predominant on the anterolateral margin.

#### REMARKS

De Man named this species without seeing specimens. He realised that the record of *Sesarma tetragona* of H. Milne Edwards (1853) from Isle de France, was wrongly identified and represented an undescribed taxon. Unfortunately there is now no indication in the collections of the MNHN, Paris, which specimens had been examined by H. Milne Edwards, or even if they still exist (D. Guinot, in litt.). One bottle containing three females (MNHN-B10887) is labelled 'Sesarma Meinerti de Man vu par M. de Man, 10

juin 1890 Ile de France'; but this is after De Man had published his new name, and there is no other indication that this was the H. Milne Edwards' material. I have considered designating a neotype, however there is currently no confusion over the identity of *N. meinerti*, and the stability of nomenclature is not threatened. Under these circumstances according to Article 75(b) of the *International Code of Zoological Nomenclature* (Third Edition, 1985) the designation of a neotype would be invalid.

This is probably the best known and best studied of the *Neosarmatium* species, and along with *N. smithi*, the most widely distributed. Early reports recorded this species from the southwestern Pacific, from eastern Australia and New Caledonia, but Serène (1973) realised that these specimens differed in a number of consistent features from typical *N. meinerti* and described a new species *N. fourmanoiri* to accept them. The characters that separate these two species are given under 'Remarks' for *N. fourmanoiri*.

#### HABITAT AND BIOLOGY

Cott (1930) and Hogue & Bright (1971) have written accounts of the ecology and natural history of *N. meinerti* in South Africa and Kenya respectively. 'Lives on the higher and drier ground adjoining the mangrove ditches ... a low lying area covered with coarse grass and intersected by tidal mangrove creeks, and being about 6-8 feet above the mud level of the ditches' (Cott, 1930: 680), Bright & Hogue (1972: 7) record 'Sandy-clay areas and higher, drier, muddy banks associated with estuaries and mangroves'. In the Northern Territory it lives in the rearward-most mangrove zone, a very dry area, inundated by high spring tides only.

'Burrows are well developed and most common in areas where there is dry, relatively hard mud. The burrows are deep and usually extend to the water table. Often the mouth of the burrow has a hood built of mud excavated while enlarging the tunnel or cleaning out. These crabs are retiring, remaining at the mouth of the burrow, and only leave to forage at night. They apparently feed primarily on plant material, but also act as scavengers where they occur in high density. There is no indication of colonialism in areas of high density' (Bright & Hogue, 1972: 7-8).

Larval stages have been described by Pereyra Lago (1989). There are five larval stages and development takes an average of 25 days at 25°C and in 35 ppt. salinity.

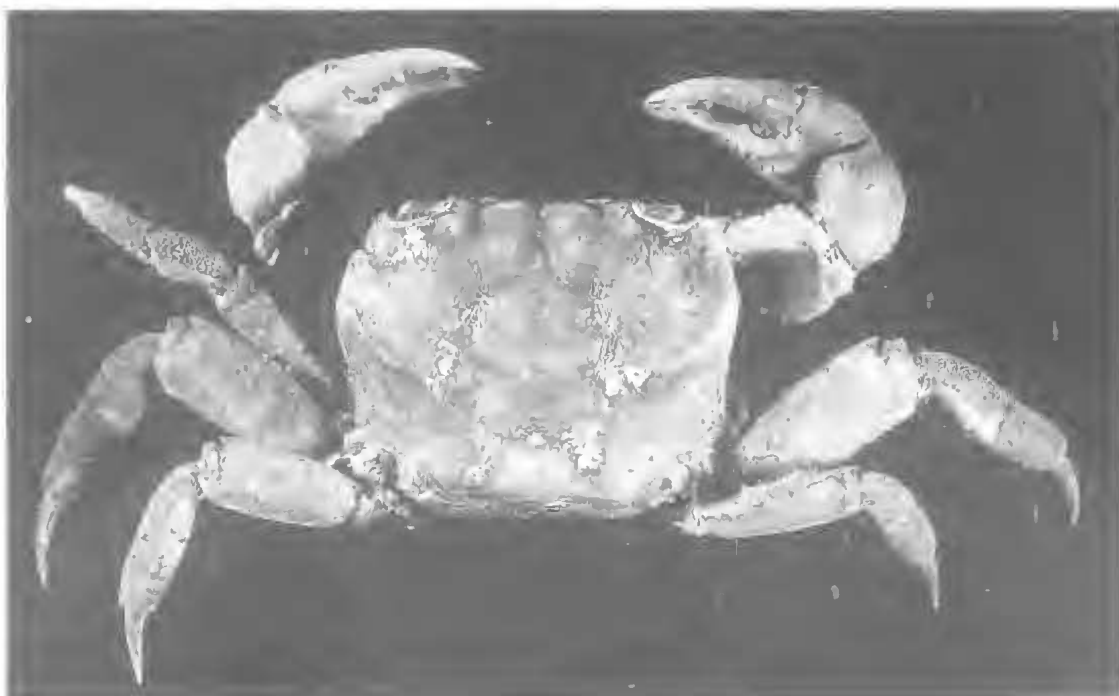


FIG. 11. *Neosarmatium punctatum* (A. Milne Edwards, 1873). Dorsal view of ♂ holotype.

#### DISTRIBUTION

Only key references given. Mauritius (type locality, H. Milne Edwards, 1853); Madagascar (Crosnier, 1965); South Africa (Barnard, 1955); Aldabra (Haig, 1984); Seychelles (Scrène, 1977a); East Africa (A. Milne Edwards, 1868; Ortmann, 1894); India (Alcock, 1900); Andamans (Alcock, 1900); Indonesia (De Man, 1895); northwestern Australia, and the Gulf of Carpentaria (present records); Philippines (Bürger, 1893); Saipan, Marianas, Micronesia (Miyake, 1938); Taiwan (Horikawa, 1940; Lin, 1949; Dai & Yang, 1991).

***Neosarmatium punctatum* (A. Milne  
Edwards, 1873)  
(Figs 11; 17)**

*Metagrapsus punctatus* A. Milne Edwards, 1873: 308, pl. 17, fig. 2.

*Sarmatium punctatum*: De Man, 1887: 660 (no new specimens).

? *Sarmatium punctatum*: Urita, 1926: 20; Sakai, 1934: 325 [? = *N. indicum*].

#### TYPE INFORMATION

Lectotype (here designated), ♂ (31.0 x 24.6

mm), MNHN-B3630. Type locality: New Caledonia.

#### MATERIAL EXAMINED

SYNTYPES: MNHN-B3630, 1 ♀ (30.8 x 23.0mm) 2 ♂ (31.0 x 24.6; 35.4 x 26.3mm), New Caledonia, M. Balansa, no date.

OTHER MATERIAL: QMW19897, ♂ (28.9 x 22.6mm), in garden at Anse Vata, Noumea, C. Henin, Feb. 1993.

#### DESCRIPTION

*Carapace*. c.1.25-1.35 times broader than long. Fronto-orbital width c.1.05-1.1 times carapace length. Depth c.0.7 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with single, forwardly directed, epibranchial tooth, triangular and blunt; similar in size to ex-orbital angle; with second small epibranchial projection. Exorbital angle triangular and sharp. Front c.0.5 times carapace width; c.0.6 times fronto-orbital width; lateral angles bluntly acute; small pre-orbital concavity present; lateral margins concave. Lateral post-frontal lobes distinctly but narrowly separated from orbital margin. Post-frontal lobes without clumps of setae. Single sharp lateral ridge running from obliquely behind last anterolateral tooth to outer edge of posterior



margin; first branchial ridge follows from posterior edge of epibranchial projection, relatively long; second arising from just short of lateral margin; third arising from lateral margin. Posterior margin c.0.5 times carapace width. Carapace surface smooth and shining, punctate; wrinkled posteriorly; without obvious setation. Upper orbital border smooth, but minutely granular laterally. Lower orbital border straight; evenly granular. Basal segment of antennal peduncle with outer tongue short, bearing thick fringe of setae on ventral edge. Inter-antennular septum c.0.4 times width of front.

*Third maxilliped.* Suture between merus and ischium sloping slightly obliquely inward. Exopod narrow, not obvious in frontal view, reaches slightly less than half length of merus.

*Chelipeds.* Merus with posterior border minutely granulate; with blunt projection; lower border granulate; anterior border tuberculate mesially and proximally, convex; carpus with inner angle granular; inner margin granular, with secondary ventral, microscopically granular ridge bearing tuft of long setae proximally; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm defined anteriorly by an indistinct longitudinal ridge. Outer surface of palm naked, punctate, granular medio-ventrally; with median longitudinal row. Inner surface of palm mainly smooth; with strongly raised granular vertical crest and with short row of 3-4 large granules obliquely at base of fixed finger. Immobile finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.45 times length propodus. Ventral border of chela convex. Dorsal surface of dactyl smooth, rounded, but bearing 2 strong blunt spines on inner margin, proximal one smaller, c.one-fifth length from base, distal one larger and placed just short of halfway; tipped with chitin; female chela with spines less prominent. Fingers pointed, but with narrow spooning; curved inwards; a wide gap between cutting margins.

*Walking legs.* Third pair slightly the longest, c.1.4 times maximum carapace width. Merus of third leg c.2.2 times as long as wide. Carpus c.2.1-2.3 times as long as wide. Propodus c.1.9-2 times as long as wide. Dactyli c.0.9-1.0 times length of propodus. Dactyli stout and slightly recurved. Carpi and propodi bear a short felt of setae on both dorsal and ventral surfaces of legs 1-3, above the accessory carinae on the carpi, and almost encircling the propodi distally; only on dorsal surface of 4th leg; felt continues in thick

rows onto the dactyli; also present on extreme distal end of upper margin of meri of legs 1-4 and on sub-distal spine.

*Male abdomen.* Male abdomen moderately broad; segment 1 the widest (segments 1-3 sub-equal). Segment 1 covers entire width of sternum between 4th pereopods; narrow. Segments 3-5 tapering (tapering strongly from 3-4, then moderately). Width segment 3 c.4.4 times length. Segment 6 elongated (moderately); 1.6 times wider than long. Telson not longer than preceding segments (sub-equal to segment 6); 1.1 times longer than wide; evenly rounded.

*Gonopods.* Could not be extracted from dry type specimens, and abdomen and gonopods missing from spirit specimen.

#### COLOUR

'Sa couleur est d'un violet foncé devenant rougeâtre sur les pattes' (A. Milne Edwards, 1873: 309).

#### REMARKS

All three type specimens must be considered syntypes, but as the smaller male, 31.0 x 24.6 mm, corresponds to the size of the only specimen mentioned by A. Milne Edwards (1873) it is here designated as the lectotype; the other two specimens become paralectotypes.

The only records for this species which can be relied on at this time are those of the type series and one recent specimen from New Caledonia. Otherwise the records must be considered to be confused between *N. punctatum* and its very closely related sister-species *N. malabaricum* from the eastern Indian Ocean. Henderson (1893) erected *Sarmatium malabaricum* as a subspecies of *N. indicum* after being told by A. Milne Edwards that his specimens were referable to *S. indicum* not *S. punctatum* as Henderson had at first supposed. It is clear that while Milne Edwards was correct in realising that Henderson's specimens were not *S. punctatum*, he erred in thinking they were like *S. indicum*. The present examination of the type material of *N. punctatum* with specimens of *N. malabaricum* from Ceylon, and photographs of the lectotype (designated by Serène, 1975), reveal that the species are extremely close. They can only be separated by: 1, on *malabaricum* the distal tooth on the upper surface of the dactyl of the cheliped is placed very close to the middle; while on *N. punctatum* it is clearly less than half way to the tip; 2, the upper surface of the palm of the cheliped has a very strong longitudinal rim marking its outer edge on



FIG. 12. *Neosarmatium rotundifrons* (A. Milne Edwards, 1869). ♂ holotype of *N. fryatti* (Tesch, 1917). A, dorsal view; B, chela; C, abdomen and sternum. Scale line in mm.

*malabaricum*, but this rim is much less distinct on *punctatum*; 3, *N. malabaricum* is c.1.16-1.22 times broader than long, compared with 1.26-1.35 for the type series of *N. punctatum*. This last character is usually quite conservative within other species of this genus and is independent of size except for very small specimens.

These two species are very similar but I believe the differences are significant enough to maintain them as separate species. It is also interesting to note that these two species also conform to the

pattern of some other *Neosarmatium* and *Sarmatium* species of having closely related sister species in the south-western Pacific Ocean e.g. *N. meinerti* and *N. fourmanoiri*; *N. smithi* and *N. trispinosum* sp. nov. (see Figs 16, 18). The distributional boundaries and/or overlap zones between *N. malabaricum* and *N. punctatum* still remain to be properly resolved.

Henderson (1893) used a number of characters to separate *S. malabaricum* from specimens of *S. punctatum* in the British Museum which had been

collected from the Indo-Malayan region and earlier identified by E.J. Miers. It is clear however that Miers also had misidentified his material and that they were really specimens of *S. indicum* that Henderson was comparing with his specimens. Serène (1975) similarly thought that the specimens from Indo-Malaya that he and Tweedie had seen in the Zoological Reference Collection, Singapore, were *S. punctatum* whereas in fact they too are *N. indicum*. This is why he erroneously restated the differences already listed by Henderson to separate *N. malabaricum* from *N. punctatum*.

#### HABITAT

Habitat information was not recorded for the type specimens; the most recent example was collected dead from a garden in Anse Vata, a suburb of Noumea.

#### DISTRIBUTION

Only definitely known from the type locality, New Caledonia. Possible records from Indonesia, and Japan, more likely refer to *N. indicum*.

#### *Neosarmatium rotundifrons* (A. Milne Edwards, 1869) (Figs 2A, B; 12; 18)

*Sesarma rotundifrons* A. Milne Edwards, 1869: 30; De Man, 1887: 648 (no specimen); Tesch, 1917: 198, 230, 246 (no specimen).

*Sesarma (Sarmatium) rotundifrons*: De Man, 1929: 111, fig. 3, 4a, 4b.

*Sarmatium fryatti* Tesch, 1917: 216-220, figs 6-8.

*Sesarma meinerti*: De Man, 1887: 648, 668-69, in part. (fide De Man, 1929).

? *Sesarma (Episesarma) meinerti*: De Man, 1895: 166 (in part: three females only).

*Neosarmatium rotundifrons*: Serène & Soh, 1970: 398: 406 (in list).

#### TYPE INFORMATION

*N. rotundifrons*: holotype, ZMH-K4195. Type locality: Upolu, Samoa.

*N. fryatti*: holotype, NNM-1955. Type locality: Nias, off the western coast of Sumatera, Indonesia.

#### MATERIAL EXAMINED

HOLOTYPE: ZMH-K4195, ♀ (34.3 x 27.1 mm), Upolu, Samoa (Museum Godefroy No. 2361).

OTHER MATERIAL: Holotype of *S. fryatti*, NNM-1955, ♂ (32.6 x 25.3 mm), Nias, E.E.W. Schröder, 1908.

#### DIAGNOSIS

Carapace smooth and shining, finely pitted, bearing short setae in small tufts; c. 1.2-1.3 times broader than long. Lateral margins sinuous; a single prominent epibranchial tooth, second tooth present but reduced to a trace; greatest carapace width across second epibranchial teeth. Frontal border strongly sinuous with a deep median concavity, less than half (c. 0.45) carapace width; postfrontal lobes strongly indicated. Posterior border straight, width subequal to front. Merus of cheliped without subdistal tooth developed on posterior margin. Inner surface of palm of male cheliped with prominent vertical granular crest; outer surface with short, prominent, sub-median, transverse crest; outer edge of upper border of palm without obvious longitudinal rim; superior margin of dactyl with 4-5 distally directed spines, evenly spaced over the proximal half; a broad gape between fingers of mature males. Meri of walking legs broad (merus of third pair c. 2.5 times longer than wide), anterior borders only slightly convex, with acute subdistal spine, dorsal face with short transverse striac; carpi and propodi with dense covering of short setae around superior margin. Male abdomen narrow; telson slightly longer than broad at base; segment 6 longer than telson, and c. 1.3 times broader (at base) than long.

#### REMARKS

De Man (1929) compared the type material of *Sarmatium fryatti* with the holotype of *Sesarma rotundifrons* and was the first to establish that these two species were synonymous. I have also re-examined the two holotypes and agree with De Man. When Tesch described *S. fryatti* in 1917, he had not seen specimens of *Sesarma rotundifrons* A. Milne Edwards, and it had still not at that time been figured. He believed it to belong to *Sesarma (Sesarma)* not to *Sarmatium*, and for this reason he failed to compare it with his new species of *Sarmatium* which he naturally thought to be undescribed. The type of *N. fryatti* is used here to illustrate the male morphology of *N. rotundifrons* for the first time.

#### DISTRIBUTION

Upolu, Samoa (A. Milne Edwards, 1869); Indonesia: Nias, off west coast of Sumatera; Java; Obi Is., Moluccas (Tesch, 1917, as *N. fryatti*)

***Neosarmatium smithi*** (H. Milne Edwards,  
1853)  
(Figs 2J, K; 13; 18)

- Sesarma smithi* H. Milne Edwards, 1853: 187; Hofmann, 1874: 24; De Man, 1887: 652-653; Bürger, 1893: 618, pl. 21, fig. 2; Ortman, 1894b: 722; Haig, 1984: 128.  
*Sesarma smithii*: H. Milne Edwards, 1854: 149, pl. 9, fig. 2; A. Milne Edwards, 1868a: 71; De Man, 1880: 29; Kingsley, 1880: 217.  
*Sesarma (Sesarma) smithi*: Rathbun, 1910: 328; Miyake, 1936: 497, pl. 35, figs 1, 2; Sakai, 1939: 686.  
*Sesarma (Sesarma) smithii*: Tesch, 1917: 199-200; Barnard, 1950: 124; Crosnier, 1965 [in part]: 59, pl. 4, fig. 2 [not figs 74, 79, 86, 102 = ? *N. trispinosum*].  
*Sesarma (Sarmatium) smithii*: Tweedie, 1936: 68.  
*Sesarma oceanica*: Chhappag, 1957: 58, pl. 16, figs d-g [not *S. oceanica* De Man, 1889 = *Pseudosesarma rotundatum*].  
*Neosarmatium smithi*: Serène & Soh, 1970: 398, 405, pl. 5A, B; Sakai, 1976: 665-666, text-fig. 364; Hirata et al. 1988: 26, colour plate; Dai et al., 1986: 496, fig. 279(3), pl. 70(2); Dai & Yang, 1991: 543, fig. 279(3), pl. 70(2).

TYPE INFORMATION

Holotype, MNHN-B3962. Type locality: Port Natal, South Africa.

MATERIAL EXAMINED

HOLOTYPE: MNHN-B3962, ♀ (37.1 x 33.1mm), Port Natal, South Africa.  
 OTHER MATERIAL: SOUTH AFRICA: QMW8861, 2♂ (30.0 x 27.9; 36.2 x 34.0mm), ♀ (35.8 x 33.3mm), Inhaca Island, Aug. 1963, W. Macnae. MADAGASCAR: MNHN-B16764, ♀ (29.6 x 27.8mm), Nosy Bé, A. Crosnier, c.1964. ZANZIBAR: MNHN-B3685, ♂ (dry), (35.6 x 32.6mm), M. Grandidier. MALAYSIA: QMW8865, ♂ (37.3 x 3.0mm), Kuala Selangor, A. Sasekumar, 1979. PHILIPPINES: NNM32716, ♀, Maribago, Mactan Island, near Cebu, coll. Gomez, 1979; ZMG628, 5♀ (29.0 - 32.8mm), 4♂ (25.8 - 30.0mm), Manila, Luzon, 3°24'N, 101°12'E, C. Semper, April 1860 - Nov. 1861.

DESCRIPTION

*Carapace*. c.1.1 times broader than long. Fronto-orbital width c.0.95 times carapace length. Depth c.0.8-0.85 times carapace width. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with two forwardly directed teeth behind the exorbital angle; exorbital angle sharp and outer margin straight; first

anterolateral tooth triangular; larger than exorbital angle; second anterolateral tooth blunt, minute but obvious. Front c.0.45 times carapace width; c.0.5-0.6 times fronto-orbital width; lateral margins slightly concave, lateral angles obtuse. Postfrontal lobes distinct, laterals c. half width of medians, poorly separated from orbit. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively long; second arising from lateral margin; third arising from, or just short of, lateral margin. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate; setae in short tufts on anterior half and posteriorly in rows along branchial lines. Upper orbital border evenly, finely, granular; oblique, slightly sinuous; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth minutely granular. Inter-antennular septum c.0.3 times width of front.

*Third maxilliped*. Suture between merus and ischium horizontal. Ischium sub-triangular; inner margin smooth. Exopod narrow, not much visible in frontal view, reaching about half length of merus; c.0.4 times width of ischium.

*Chelipeds*. Merus with posterior border minutely granulate and faintly striated; with distinct subdistal spine; lower border minutely granulate; anterior border with small granules or tubercles mesially on outer edge of lip; carpus with inner angle armed with a few sharp granules; inner margin unarmed except for a row of granules, and a tuft of long setae proximally on secondary ventral ridge of inner margin; granules present on inner face of carpus just below inner angle; outer margin with granular striations. Upper surface of palm defined anteriorly by a swollen longitudinal ridge. Outer surface of palm naked; with a median longitudinal row. Inner surface of palm smooth except for strongly raised granular vertical crest continuing obliquely for about two-thirds of fixed finger. Immobile finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.5 times length propodus. Ventral border of chela slightly convex, coarsely granular posterior to fixed finger. Dorsal surface of dactyl bearing a small blunt proximal tubercle on inner edge, followed by a large, truncate, chitinous tooth, followed by a smaller tooth of similar form, all three evenly separated over proximal half; otherwise smooth.

*Walking legs*. Second and third pairs sub-equal and longer than others. Longest leg c.1.7 times maximum carapace width. Merus of third leg c.2.2-2.5 times as long as wide. Carpus c.2.3-2.5

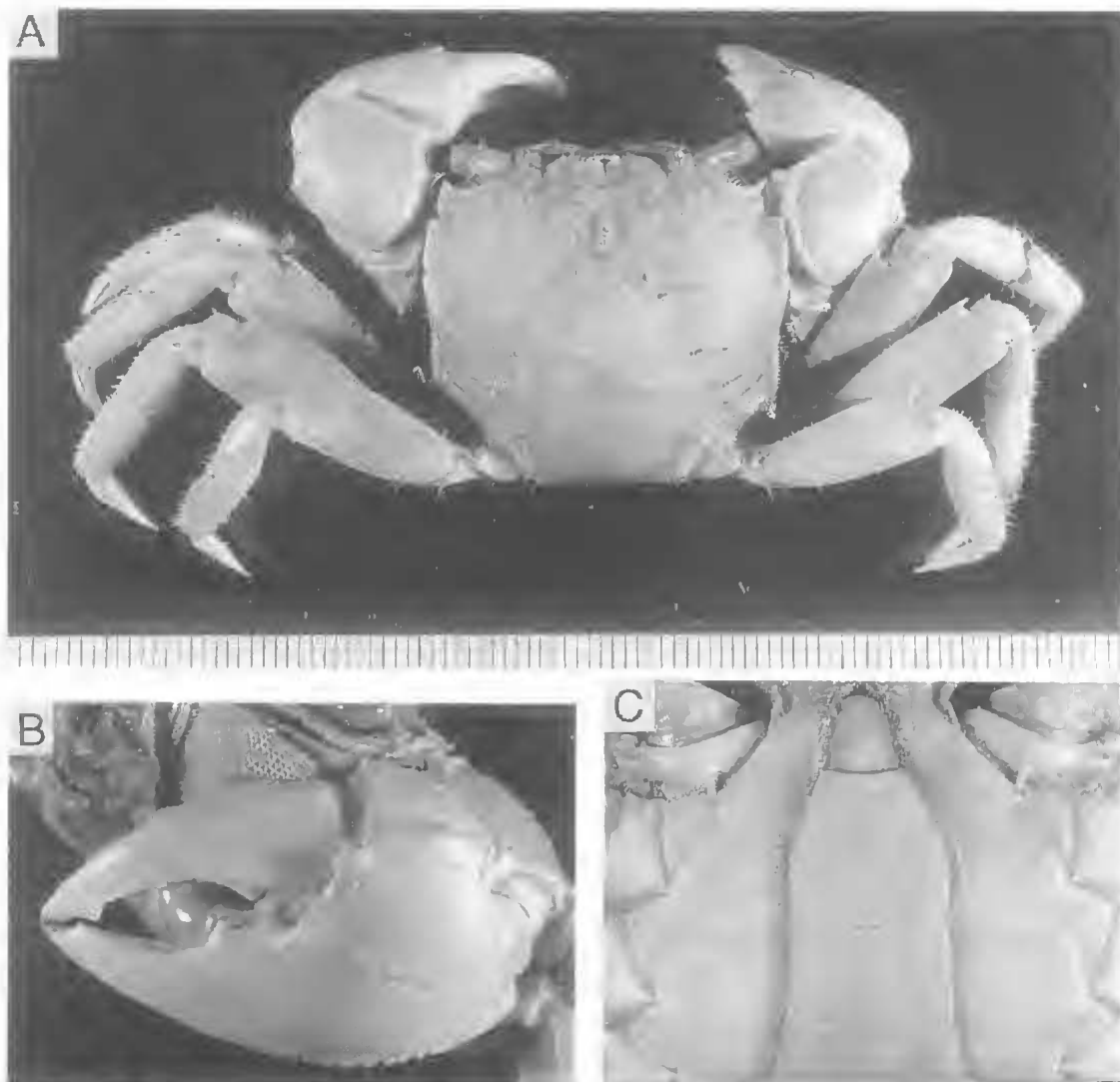


FIG. 13. *Neosarmatium smithi* (H. Milne Edwards, 1853), ♂, QMW8861. A, dorsal view; B, chela; C, abdomen and sternum. Scale line in mm.

times as long as wide. Propodus c.2.2-2.4 times as long as wide. Dactyli c.0.8-0.9 times length of propodus.

*Male abdomen.* Width segment 3 c.3.2-4.0 times length. Segment 6 elongated, longest, length and width subequal. Telson not longer than preceding segments, sub-equal to segment 5; 1.3-1.5 times longer than wide; evenly rounded.

*Gonopods.* G1 inner-dorsal margin straight. Dorsal surface of stem flattened, concave; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex.

Distal part of the stem narrow. Apical process present, corneous, strongly produced, straight. Gonopore terminal. Setae present, short, simple, lie around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

#### COLOUR

Dorsal carapace, legs, and merus and carpus of chelipeds, dark purple; outer face of chela and fingers bright red, but with dark dorsal dactylar teeth.

## REMARKS

This widespread species has been wrongly identified in the south-western Pacific region, where it is replaced by a sister species *Neosarmatium trispinosum* sp. nov. In part, this has been caused by the fact that the holotype is a female, and the arrangement of the spines on the superior border of the dactyl of the cheliped is unclear. On *N. smithi* the dorsal surface of dactyl bears a small blunt proximal tubercle on the inner edge, followed by a large, truncate, chitinous tooth, and then a smaller tooth of similar form, all three evenly separated over proximal half. On *N. trispinosum* however, there are also three teeth but they take the form of large, acute, conical, chitinous spines, set close together in proximal two-fifths, the smallest being near the articulation as in *N. smithi*, but it is the third, most distal tooth, that is the largest. Even though these spines are vestigial in the female, traces of them can be found on careful examination, and therefore this is still a good character for discriminating between the species using a specimen of either sex.

Ecological studies referring to this species by Giddins et al. (1986), Neilson et al. (1986), Neilson & Richards (1989) are all actually referring to *N. trispinosum* sp. nov.

## HABITAT

Mangroves (Rathbun, 1910; Crosnier, 1965). Pinto (1984) noted that they live in complex burrows that have the entrance protruding above the soil surface as a hollow cylinder reinforced by mangrove roots; they actively built these 'castles' after rains when the burrows were flooded. He found them to be mainly nocturnal.

## DISTRIBUTION

Southern Africa and Madagascar - Port Natal (H. Milne Edwards, 1853); Nossi-Faly (near Madagascar) (De Man, 1880); Madagascar (Crosnier, 1965); Aldabra (Haig, 1984). India - Bombay (Chhappgar, 1957 as *Sesarma oceanica*). Sri Lanka (Pinto, 1984). S.E. Asia - Lem Ngob, Thailand (Rathbun, 1910); Singapore (Tweedie, 1936); Malaysia, Philippines (present records); Hainan Is., China (Dai & Yang, 1991); extending as far north as Okinawa, Ryukyu, Japan (Sakai, 1976; Hirata et al., 1988).

*Neosarmatium trispinosum* sp. nov.

(Figs 2H, I; 14, 18)

*Sesarma smithi*: A. Milne Edwards, 1873: 305; De Man, 1889: 426; 1890: 94; McCulloch, 1913: 322.

*Sesarma (Episesarma) smithi*: Nobili, 1899: 267.

*Sesarma (Neosarmatium)* sp.: Davie, 1982: 207.

## MATERIAL EXAMINED

HOLOTYPE: QMW5143, ♂ (31.3 x 29.2mm), Serpentine Ck, Moreton Bay, SE.QLD, 27°24'S, 153°07.0'E, mangroves, on sandy substrate, 11.8.1972, B. Campbell.

PARATYPES: MNHN unreg. ♂ (41.2 x 36.4mm), New Caledonia. [♂ pleopod figured]; QMW19556, 3 ♀ (22.9 x 20.2; 30.8 x 28.3; 39.0 x 35.1mm), mangroves at Pam, northern New Caledonia, 27.2.1992, J.-L. Menou; SMF1987, 2♂ (38.5 x 36.4; 42.3 x 38.6mm), Fiji; NNM743, ♀ (24.7 x 21.7mm), ♂ (24.8 x 21.9mm), Ormeuine Base G, Hollandia, New Guinea, G. Van Hout; MNHN unreg. (Serène colln), ♂ (31.6 x 28.4mm), Vanuatu, R. Serène, 10.10.1971; SMF unreg., ♀ (31.2 x 26.9mm), ♂ (34.6 x 31.6mm), Cape Ferguson, near A.I.M.S., south of Townsville, NE.QLD, mangroves, M. Türkay, 11.6.1980; QMW9137, ♂ (25.9 x 3.2 mm), Annie River, NE.QLD, 14°25'S, 143°34'E, 20.5.1973, B. Campbell, small creek near jetty (Loc 4); QMW8864, ♂ (31.5 x 28.2mm), Endeavour River, Cooktown, NE.QLD, 15°28'S, 145°15'E; QMW8876, ♂ (16.4 x 14.2mm), Barron River, near Cairns, NE.QLD, 16°52'S, 145°42'E; QMW8872, ♂ (36.1 x 33.8mm), Cairns, NE.QLD, 16°55'S, 145°46'E, 5.3.1962; QMW8875, ♂ (13.3 x 11.7mm), Johnstone R., nr Flying Fish Point, nr Innisfail, NE.QLD, 17°3'S, 146°05'E; QMW8866, ♂ (28.7 x 25.9mm), on road to Lucinda (near Ingham), NE.QLD, 18°32'S, 146°2'E, 20.3.1962, W. MacNae; QMW8871, ♂ (33.7 x 31.0mm), Ross Creek, Townsville, NE.QLD, 19°16'S, 146°49'E; QMW8869, ♀ (27.9 x 24.6mm), South Townsville Inlet, NE.QLD, 19°17'S, 146°5'E; QMW8976, 2 ♀ (31.0 x 28.6; 32.2 x 28.8mm), 2 ♂ (31.7 x 28.8; 31.9 x 29.8mm), Chunda Bay, Hinchinbrook Island, off Townsville, NE.QLD, 19°17'S, 147°03'E, I. Kneipp; QMW8870, ♂ (32.7 x 29.7mm), Bassett Creek, Mackay, ME.QLD, 21°09'S, 149°11'E; QMW8838, ♂ (34.4 x 31.6mm), Deepwater Bend, South Pine River, SE.QLD, 27°2'S, 153°E, 1.3.1950, G. Davis; QMW8839, ♂ (30.3 x 27.5mm), Deepwater Bend, South Pine River, SE.QLD, 27°2'S, 153°E, 26.3.1950, G. Davis; QMW8862, ♂ (33.6 x 30.5mm), Fishermen Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, Nov. 1964, B. Campbell; QMW8863, ♂ (34.0 x 30.5mm), Brisbane River, SE.QLD, 27°23'S, 153°1'E, 1964, B. Campbell; QMW8867, ♂ (34.4 x 30.7mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, Nov. 1964, B. Campbell; QMW8868, ♂ (33.3 x 30.3mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E; QMW8873, ♀ (31.2 x 28.0mm), Fisherman Island, Brisbane River, SE.QLD,

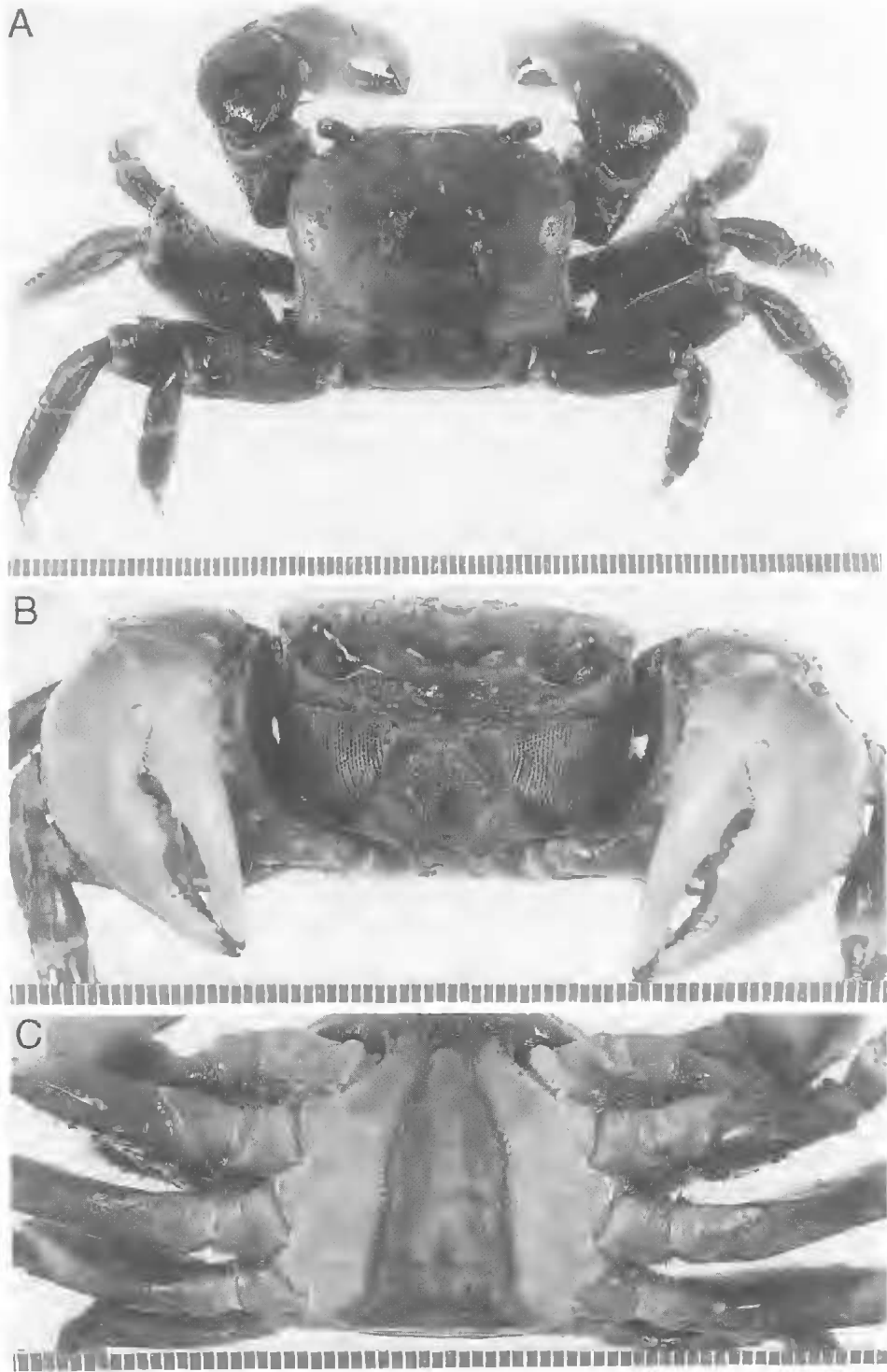


FIG. 14. *Neosarmatium trispinosum* sp. nov., ♂ holotype, QMW5143. A, dorsal view; B, frontal view; C, ventral view. Scale line in mm.

27°23'S, 153°1'E; QMW8874, ♀ (22.8 x 20.7mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, 16.10.1958, B. Campbell, large (75mm) burrows in mud, H.W.S.

OTHER MATERIAL: MNHN-B16763, ♂ (33.6 x 30.4mm), label states 'Provenance inconnue'.

#### DESCRIPTION

*Carapace.* c.1.1 times broader than long. Fronto-orbital width c.0.95 times carapace length. Depth c.0.8 times carapace width. Cardiac region indistinct. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with two forwardly directed teeth behind the exorbital angle. Exorbital angle sharp and outer margin straight. First anterolateral tooth blunt; larger than exorbital angle. Second anterolateral tooth minute, blunt. Front c.0.45 times carapace width; c.0.55 times fronto-orbital width; lateral angles obtuse; with slight, small, pre-orbital concavity; lateral margins slightly concave. Lateral post-frontal lobes very narrow, not as swollen as medians. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively long; second arising from lateral margin; third arising from, or just short of, lateral margin. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate. Setae in short tufts on anterior half and posteriorly in rows along branchial lines. Upper orbital border evenly finely granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.3 times width of front.

*Third maxilliped.* Suture between merus and ischium horizontal. Ischium sub-triangular; inner margin smooth. Exopod narrow, not much visible in frontal view, reaching about a half length of merus; c.0.3 times width of ischium.

*Chelipeds.* Merus with posterior border minutely granulate and faintly striated; with distinct, small, subdistal spine; lower border granulate; anterior border smooth; carpus with inner angle slightly produced, armed with a few sharp granules; inner margin unarmed, a tuft of long setae proximally on secondary ventral ridge of inner margin; granules present on inner face of carpus just below inner angle; outer margin with sparse granular striations. Upper surface of palm defined anteriorly by swollen longitudinal ridge. Outer surface of palm, naked, punctate; with median longitudinal row. Inner surface of palm mainly smooth; with a strongly raised granular vertical crest, continuing obliquely for about 2/3 of fixed finger. Immobile finger slightly flattened on outer surface; moderately long; length

cutting edge c.0.5 times length propodus. Ventral border of chela slightly convex; coarsely granular posterior to fixed finger. Dorsal surface of dactyl bearing 3 large acute chitinous spines set close together in proximal two-fifths, forwardly directed, conical, smallest near articulation, largest distally; otherwise smooth. Fingers pointed; curved slightly inwards; a wide gap between cutting margins.

*Walking legs.* Second pair slightly the longest, c.1.6 times maximum carapace width. Merus of third leg c.2.3 times as long as wide. Carpus c.2.5 times as long as wide. Propodus c.2.2 times as long as wide. Dactyli c.0.9 times length of propodus. Short setae in fringing rows and on accessory carinae.

*Male abdomen.* Segment 1 c.0.95 times width segment 3. Width segment 3 c.3.6 times length. Segment 6 the longest, length and width subequal. Telson c.1.3 times longer than wide; evenly rounded.

*Gonopods.* G1 inner-dorsal margin straight. Dorsal surface of stem concave; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae present, short, simple; lie around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

#### COLOUR

Dorsal carapace, legs, and merus and carpus of chelipeds, dark reddish chocolate; outer face of chela and fingers bright red, but with fingers becoming creamy yellow distally.

#### REMARKS

The closest relative of this species is *Neosarmatium smithi* (H. Milne Edwards), with which it has been wrongly identified in the past. The most distinctive feature distinguishing *N. trispinosum* from *N. smithi* is the shape and arrangement of spines on the dactyl of the male cheliped (as discussed under *N. smithi*). On *N. trispinosum* the three spines are acute, and placed close together in the proximal two-thirds; whereas in *N. smithi* they are truncate, and spaced out over the proximal half.

The label of the male specimen MNHN-B16763, states 'Provenance inconnue'. This was the specimen that was illustrated by Crosnier (1965; figs 74, 79, 86, 102) as representing a



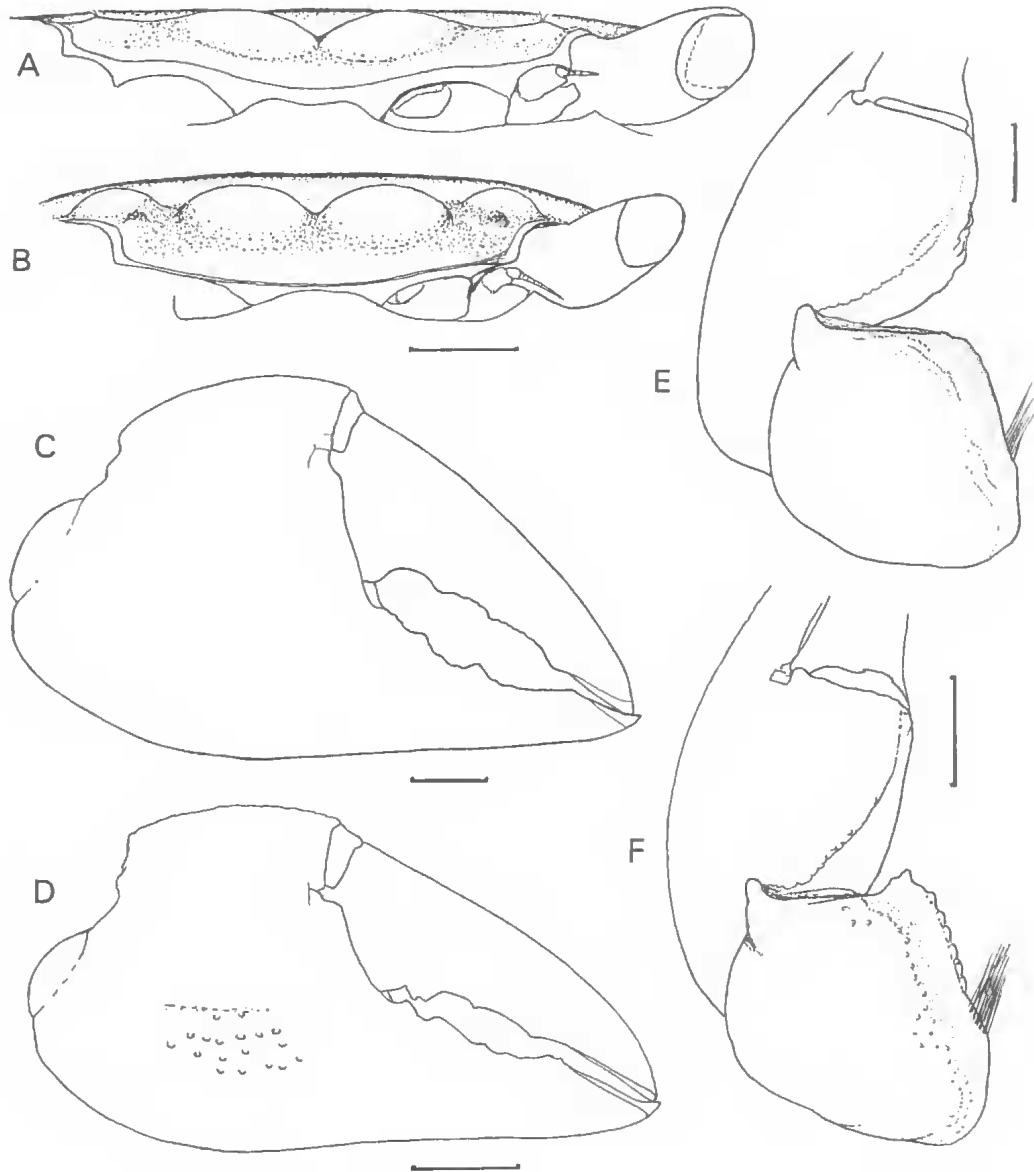


FIG. 15. A, C, E, *Neosarmatium inerme* (De Man, 1887), ♂, ZMH-K4080 (18.5 mm c.b.); B, D, F, *Neosarmatium spinicarpus* sp. nov., holotype. A, B, Frontal view showing shape and size of postfrontal lobes; C, D, right chela, frontal view; E, F, dorsal view of carpus and palm. Scale line = 2mm

Madagascan specimen of *Neosarmatium smithi* (A. Crosnier pers. comm.). It is extremely close to *N. trispinosum* sp. nov. and I consider it to be an aberrant specimen of this species which has simply lost the smallest, most proximal spine on the dactyl of the cheliped. It is more than likely

that the species was collected in New Caledonia, or in nearby French controlled territories in the Western Pacific.

#### HABITAT

*Neosarmatium trispinosum* builds large char-

acteristic mounds at the entrance to its burrow. In southeast Queensland it occurs from the mid- to upper-intertidal zones, amongst *Avicennia* and *Ceriops*. Around Townsville, north Queensland, '*Neosarmatium smithi* [= *N. trispinosum*] ... is the dominant crustacean in the *Ceriops tagal australis* zone of mangroves ... 3.1 m above chart datum, and is infrequently immersed. The crab emerges from its burrow at night to remove litter from the surface of the mud...' (Giddins et al., 1986: 147). This species is a major leaf consumer, with vegetable matter comprising over 90% of its diet; it carries leaves into its burrow where they are allowed to age and decay prior to consumption (Giddins et al., 1986; Neilson et al., 1986; Neilson & Richards, 1989).

#### DISTRIBUTION

From the Brisbane River north to the Annie River, Cape York, in eastern Australia; New Caledonia (A. Milne Edwards, 1873); Vanuatu (present record); New Guinea (Nobili, 1899 & present record); Fiji (De Man, 1889).

#### *Neosarmatium spinicarpus* sp. nov. (Figs 15B, D, F; 16)

*Sesarma* (*Sarmatium*) *inermis*: Tweedie, 1940: 109; 1950b: 353.

#### MATERIAL EXAMINED

HOLOTYPE: ZRC1964.9.3.500, ♂ (15.0 x 12.3mm), Stambak, Saribas, Sarawak, Borneo, L.K. Charles, 1952.

PARATYPE: ZRC1964.9.3.501, ♂ (17.4 x 14.4mm), data as for holotype.

OTHER MATERIAL: ZRC1964.9.3.502, ♂ (10.5 x 8.6mm), Kuching, Sarawak, Borneo, M.W.F. Tweedie, 1950; ZRC1964.9.3.504, ♂ (9.7 x 8.2mm) Sedili River, Johore, Malaysia, M.W.F. Tweedie, 1950.

#### DIAGNOSIS

This species is extremely similar to *N. inermis* with which it agrees in overall description and appearance, except for the following differences. 1, inner angle of carpus of cheliped marked by acute granular projection (cf. Fig. 15E, F). 2, outer medioventral portion of palm of cheliped with slightly more prominent transverse ridge and more prominent rounded granules below it (cf. Fig. 15C, D). 3, inner face of palm with cluster of rounded granules behind base of fixed finger, but not extending as vertical granular row behind gape as on *N. inermis*. 4, cutting margin of fixed finger bears two uneven granular teeth

proximally, the inner-most (on very edge of joint) is lacking in *N. inermis* (cf. Fig. 15C, D). 5, median frontal lobes of carapace are considerably more swollen, and separated by a broad U-shaped channel; lateral lobes are subacute, topped with a few small granules, and followed posteriorly by a swollen lobe. In *N. inermis* the median lobes are low, and close together, being separated by a shallow V-shaped incision; the lateral lobes are low and smooth, topped with 1-2 stiff, short setae, and not followed posteriorly by an obvious swelling (cf. Fig. 15A, B).

#### REMARKS

Neither of the type specimens have fully mature chelipeds i.e. there is not yet a significant gape formed, and the fingers are relatively slender, both of which are characteristics of young males. The degree of granulation and the prominence of the inner angle of the carpus are characters that can vary with maturity, however the largest male was larger than comparative specimens of the closely related *N. inermis* and the large series of specimens of *N. inermis* were very consistent in the characters that I have used to separate the new species. No clear differences however could be seen in the male gonopods. The two smaller males examined, one from Sarawak and one from Johore, Malaysia, do not have a strongly acute projection on the inner angle of the carpus, and have very little granulation generally, but they still have very undeveloped chelae. They are considered too juvenile to identify with certainty as either *N. inermis* or *N. spinicarpus*, and therefore are excluded from the type series, and the record from Malaysia should be considered tentative.

#### HABITAT

Tweedie (1940: 109) recorded what is probably this species (under the name *Sesarma inermis*) "from among nipah palms beside the river Sedili."

#### DISTRIBUTION

Known with certainty only from Sarawak; probable records from Malaysia (see Remarks).

#### ACKNOWLEDGEMENTS

I am indebted to Dr Alain Crosnier of ORSTOM for obtaining funding for me to undertake this study, and for his encouragement; and the Board of Trustees of the Queensland Museum for support and travel assistance. A large part of the work was undertaken while at the Laboratoire de Zoologie (Arthropodes), Muséum national d'

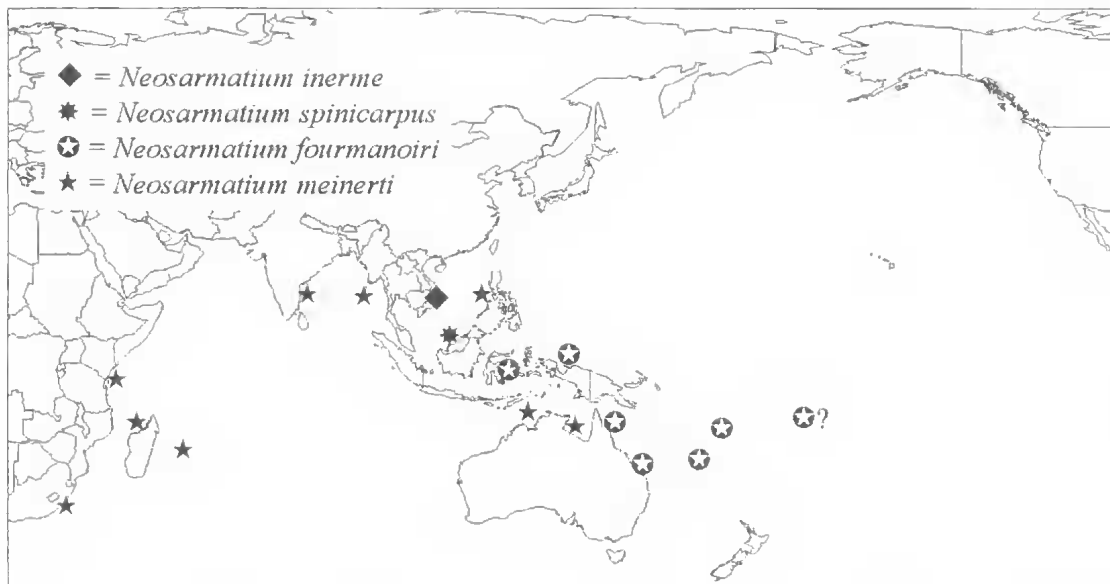


FIG. 16. Map showing the distribution of *Neosarmatium inerne*, *N. spinicarpus*, *N. fourmanoiri* and *N. meinerti*. Symbols are intended to show the major distribution records, and therefore it has not been attempted to show every confirmed record, especially when these are closely adjacent.

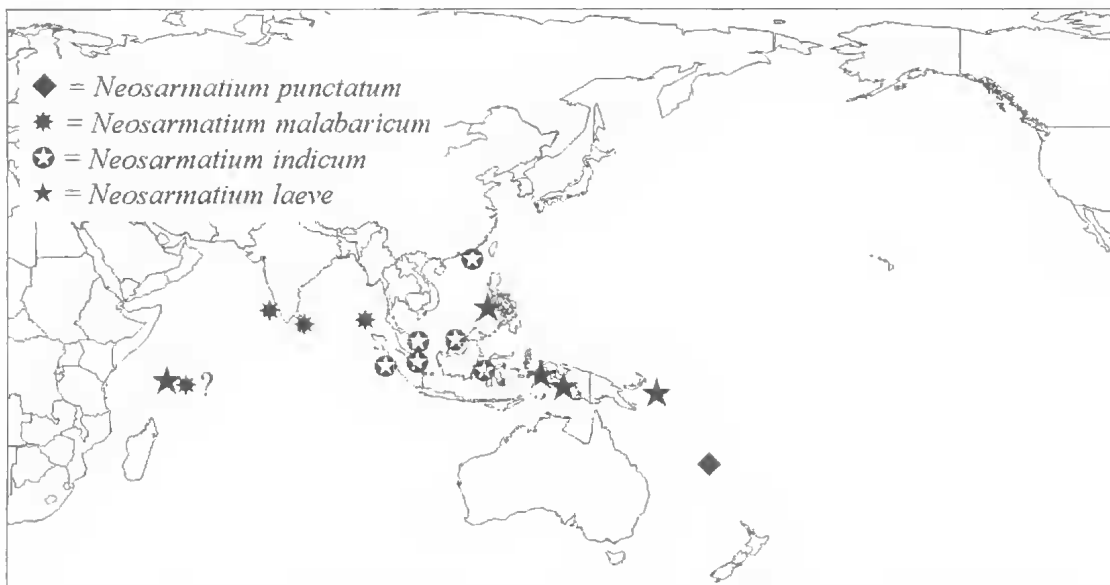


FIG. 17. Map showing the distribution of *Neosarmatium punctatum*, *N. malabaricum*, *N. indicum* and *N. laeve*.

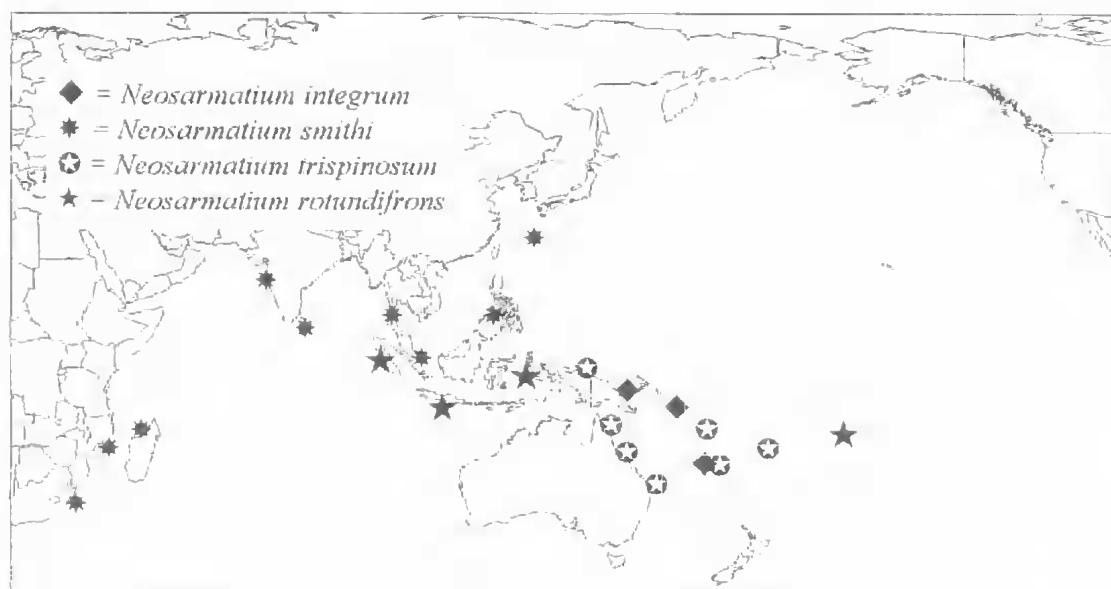


FIG. 18. Map showing the distribution of *Neosarmatium integrum*, *N. smithi*, *N. trispinosum* and *N. rotundifrons*.

Histoire Naturelle, Paris, under a grant from the Institut française de Recherche Scientifique pour le Développement en Coopération (ORSTOM). Dr Danièle Guinot kindly arranged the loan of comparative specimens, and searched the MNHN for the type of *N. meinerti*. Dr Charles Fransen of the Nationaal Natuurhistorisch Museum, Leiden, and Dr Michael Türkay of the Forschungsinstitut Senckenberg, Frankfurt, and Mrs C.M. Yang of the Zoological Reference Collection, National University of Singapore, are all sincerely thanked for their generosity and kindness whilst I was visiting their laboratories and for the loan of specimens. Dr László Forró of the Hungarian Natural History Museum, Budapest, very graciously sent me negatives of *N. biroii*. John Short of the QM, and Jacques Rebière of the MNHN, Paris, are thanked for their assistance with photography and help with preparation of plates. M. Maurice Gaillard executed the excellent illustrations of male gonopods. Bob Domrow again graciously advised me on nomenclatural matters. Ray Manning of the USNM, and Peter Ng of the University of Singapore, refereed the manuscript and their careful reading and suggestions have greatly improved the final version. I thank finally my wife Kathleen for her loving support and practical assistance with compiling the manuscript.

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